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Things Which Live or Which Have Lived

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New Flat-Field Eyepieces for Photomicrography*

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WHETHER it be viewed by direct visual observation, or indirectly by projection — as in the case of a microscope and camera arrangement for photomicrography — the image produced by the compound microscope is a product of two separate optical systems, namely, the objective and the eyepiece (or "ocular"). The objective forms a primary image of the object in the upper end of the microscope body tube which image is then reformed by the eyepiece for either of the purposes mentioned.

The form of eyepiece most commonly encountered is the type designed expressly for visual observation, and several types are required to provide some degree of correction for certain residual aberrations of the objectives with which the eyepieces are to be used. Microscope manufacturers usually list combinations of objectives and eyepieces which provide the optimum corrections for visual and photographic purposes.

To the average microscope user, one of the chief annoyances relative to the ultimate image obtained is the proportion of field in focus at one moment. In visual work this curvature of field is compensated to some extent by the accommodation ability of the eye. However, when the same eyepiece is employed to project a real image to the screen of the photomicrographic camera, the area of flatness is frequently found to be disappointingly small relative to the whole field of view.

Although lack of image sharpness outside the central area of the field of view is commonly referred to as curvature of field, there are other aberrations contributed by the objective which affect the overall quality of the final image and which the lens designer must take into consideration when designing the eyepiece.

The express function of a microscope objective is to produce, as nearly as possible, a magnified image of an object clearly defined, true in shape and detail, and free from color defects. To accomplish this the designer's efforts are concentrated on reducing to a minimum, the spherical and chromatic abberrations and coma. When these corrections are obtained within practical limits, the image of a tiny, colorless object located relatively near the axis of the objective will be seen sharply defined and without haze or spurious color. But, as the object is moved farther from the axis, it will be found that the image moves closer to the objective — indicating that the image plane is not flat. The image will also start to demonstrate color, becoming outlined with a minute spectrum — with red the innnermost color and blue to the outside. This latter effect is due

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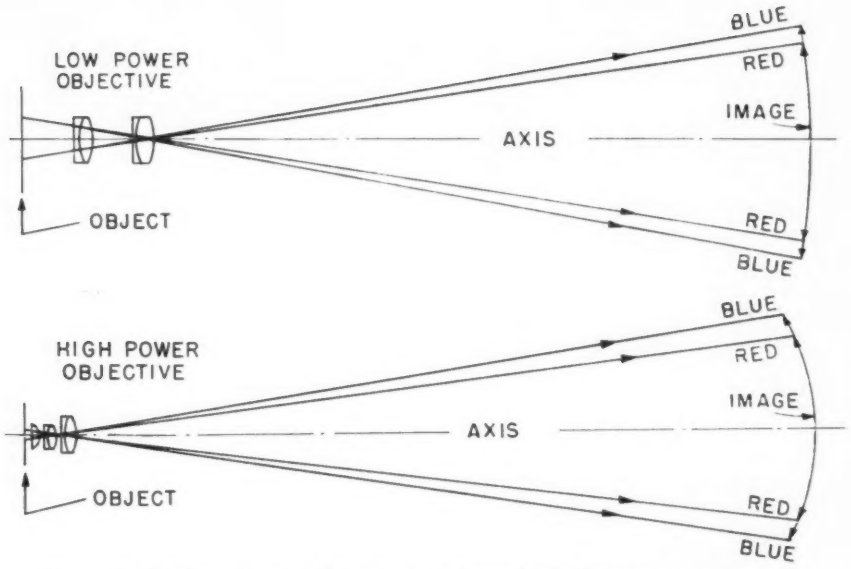

Figure 1. Field curvature and lateral color in image formed by microscope objective.

to the fact that in the refracting type of objective the index of the refracting elements varies with the wavelength of light. The result is that the objective has slightly different focal lengths for the different colors. This aberration is referred to as Chromatic Difference of Magnification or, Lateral Color. It is not to be confused with longitudinal chromatic aberration for which the objective can be well corrected.

All medium and high power microscope objectives demonstrate curvature of field and lateral color. These aberrations result from the very strong front lens elements necessary to obtain the desired magnification and numerical aperture. The remaining lenses of the objective serve to correct for the spherical, chromatic and comatic aberrations introduced by the first elements. But the curvature of field and lateral color — which causes an off-axis object point to be imaged at different size for each color — cannot be fully compensated at the same time as the other aberrations.

Figure 1 illustrates the two defects referred to. A high power and a low power objective are diagrammed. As a ray of light from an off-axis object point describes a corresponding point in the image it is seen that that image point lies closer to the objective than the image of a point directly on the axis. The images of all points between these two points would describe the curved image plane shown. It is also shown that since the focal length of the objective is shorter for blue light than for red the magnification, off-axis, for an object in blue light is greater than it is for red. The figure further illustrates the fact that the field curvature and lateral color are appreciably less for low power objects with correspondingly low numerical aperture.

The effect of curvature of the image plane is illustrated in Figure 2. Al-

though the center of the field is sharply in focus the outer edge of the field is out of focus.

The degree to which these aberrations are present varies with the power of the objective. Low powers in the range of 48 to 16mm, for example, with low N.A. (.08 to .25), show relatively flat fields and little of the lateral color. These effects become particularly prominent in the higher power range and because the degree varies with the type of objective, different types of eyepieces are made, to provide the necessary additional correction to give the optimum image quality with the various objective forms. The eyepieces are variously designated by the manufacturers. The Huygens, Hyperplane, and Compensating are examples.

Disregarding some of the conventional parlance of the lens designer, we can, for the immediate discussion, consider that the commonly used microscope eyepieces are positive in character. That is, for our purposes with respect to photomicrography they form a real image (of the primary image) in space at the film plane of the camera. The same conditions of projection can be met by substituting a negative lens system in place of the positive, visual eyepiece. Contrariwise, the negative lens system — so called because it is negative with respect to focal length as in the case of a lens with concave surfaces — cannot be used for direct visual observation, because the pupil or eyepoint of the microscope becomes virtual and is formed somewhere within the system. The negative lens system intercepts the light rays from the objective before they converge to form the primary image within the body tube, and re-direct these rays to form a magnified primary image outside the microscope and at the desired distance from it.

For the purpose of projection as in the case of photomicrography the negative lens systems are attractive because of their field-flattening possibilities. The negative lens has curvature of field but

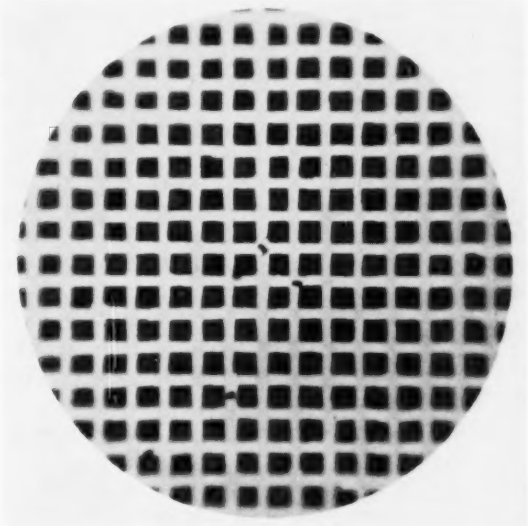

Figure 2. Curvature of Field. The center of the field is sharp but the focus falls off toward the outer edge.

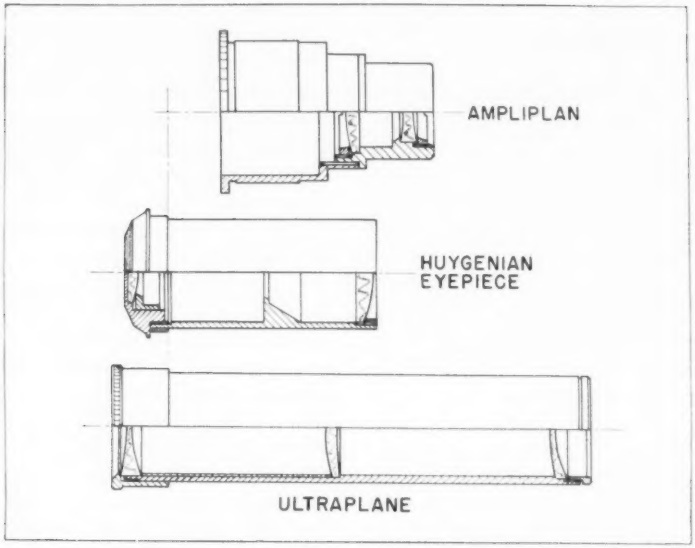

Figure 3. General form of Ultraplane compared with its predecessor, the Ampliplan, and a conventional visual type eyepiece.

it is negative in sign compared to the positive curvature produced by a lens such as the microscope objective, as shown in Figure 1. Hence, the negative lens system can be made to counteract some field curvature of the objective.

Either the positive visual type eyepiece or the negative lens type can be made to compensate for the lateral color in the image formed by the objective. However, neither one can be made to completely compensate the field curvature of the high power objectives.

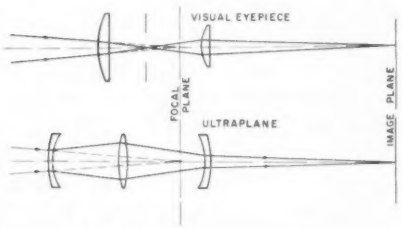

Figure 4. Image formation in visual and Ultraplane eyepieces.

Representative examples of the negative lens type of eyepiece for photomicrography are the Bausch & Lomb *Ampliplans* and the *Homal* series made by the firm of Carl Zeiss. While these lenses were designed to provide a flatter field than realized with the conventional positive type eyepieces, the fields obtained were rather small. Furthermore their mechanical design is such that they are not directly interchangeable with the visual eyepieces, necessitating the use of special adapters for the microscope body tube. For these reasons the lenses have not been generally adopted by the photomicrographers.

In an effort to circumvent the mechanical inconveniences and to produce a lens system that would provide a larger flat field than that obtained with existing negative lenses, studies were made of such eyepiece forms. As a result of these studies a lens system was developed which permits the use of lenses of small

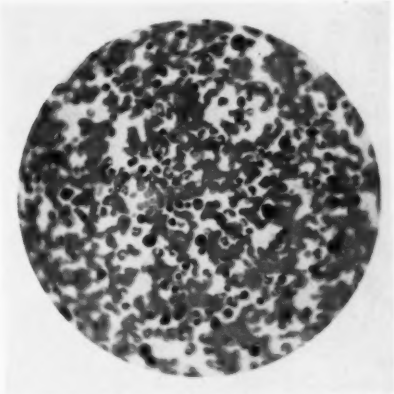

Figure 5. Field of 4mm 0.95 N.A. Apochromat with 10X Compensating Eyepiece.

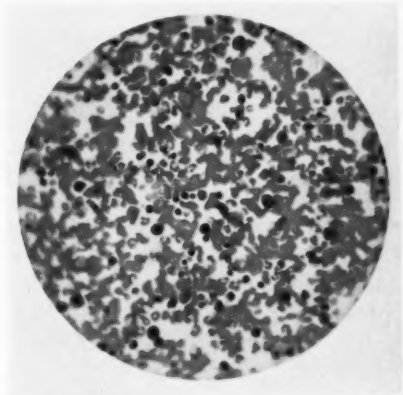

Figure 6. Field of 4mm 0.95 N.A. Apochromat with High Ultraplane.

diameter but which still pass the necessary image-forming light rays, making possible a mounting which is directly interchangeable with the standard microscope eyepieces.

The general form of the new lens system which has been given the trade designation *Ultraplane* eyepiece is shown diagrammatically in Figure 3 in comparison with a Bausch & Lomb *Ampliplan* — which the new lens supersedes — and an eyepiece of the Huygenian form. The position of the lenses is shown relative to the normal eyepiece shoulder in each case. It can be seen how the Ampliplan causes mechanical problems due to the larger lenses being recessed below the shoulder plane.

The principle of operation of the new *Ultraplane* compared to that of the visual eyepiece is shown in Figure 4. In the case of the *Ultraplane* the first two lenses (to the left) serve to move the primary image (formed by the objective) outward from the normal focal plane, when it is further projected by the third lens out to the final film plane. The desired correction for lateral color in the primary image is accomplished by choosing the right glass for the lenses. The greater portion of the field flattening effect is produced by the outer lens.

Three forms of *Ultraplane* have been designed: high, medium, and low, to match correction required for objectives in high, intermediate, and low power ranges. The low *Ultraplane* serves with objectives from 48mm 0.08 N.A. up to the 16mm 0.25 N.A. or 0.30 N.A. The medium *Ultraplane* is for 8mm 0.50 achromatic, 8.3mm 0.65 N.A. apochromatic and 4mm 0.65 N.A. achromatic objectives. The high *Ultraplane* is for "high dry" (4mm 0.85 achromat or 0.95 apochromat) and oil immersion objectives of achromatic, apochromatic or fluorite (semi-apochromatic) form.

Figure 5 shows full field obtained with a 4mm 0.95 N.A. apochromat and 10X compensating eyepiece.

Figure 6 shows field with the high *Ultraplane* eyepiece; same objective and magnification. For these figures the aperture of illumination was about 0.8 the full N.A. of objective. Tungsten illumination with ribbon filament source, X-1 No. 11 filter and *Panatomic-X* film. Beyond these data other photomicrographic details are immaterial.

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New Audio-Visual Methods in Postgraduate Medical Education*

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University of Utah College of Medicine

MR. CHAIRMAN, Ladies and Gentlemen, it is indeed a pleasure to have this opportunity to speak to you about the two new audio-visual methods that we have used in our program of postgraduate medical education. I am sorry that I am unable to be with you today but I hope this presentation in absentia will be of some value. My colleague, Mr. Howard Tribe, Head of our Department of Medical Illustration, has been active in both programs, and I am sure he can answer any questions you may have.

The University of Utah College of Medicine, the only medical school between Denver and the Pacific Coast, has attempted to provide a program of postgraduate medical education for the scattered physician population in the Intermountain West. Utilizing the traditional methods we have sponsored short postgraduate courses at the medical school and have sent teams of physicians from the medical school to outlying communities to conduct seminars for small groups of practicing doctors. Attendance to these medical school courses require the physician to travel great distances and leave a busy practice unattended. Even though the Rural Seminars have been successful they are expensive of faculty time and require both the physician and the medical school faculty to travel to a distant community for the seminar. During the past year much attention has been given to supplying the busy rural practitioner with methods of continuing his medical education without leaving his community. Utilizing audio-visual methods two new approaches to postgraduate medical education were developed, these being the Audio-Visual Seminar Kit and Postgraduate Television Clinics. It is the purpose of this paper to discuss briefly each of these new approaches and show you examples of the materials presented.

The first of the methods used in giving the physician an opportunity to review certain fields of medicine in the peace and quiet of his own home is the *Audio-Visual Seminar Kit*. As can be seen on the first slide** (Fig. 1) this kit consists of a small, red, wooden box designed for shipping with the trademark of the Postgraduate Division on the front. This kit contains a medical discussion recorded on 33⅓ r.p.m. long-playing records, suitable visual material recorded on 35mm *Kodachrome* slides, a table top slide viewer, and a script of the medical discussion. A physician wishing to use one of these kits need only supply a record player

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** This paper is published as given from the recording. However, the illustrations have been given figure numbers, corresponding to the slide numbers.

Figure 1 (a).

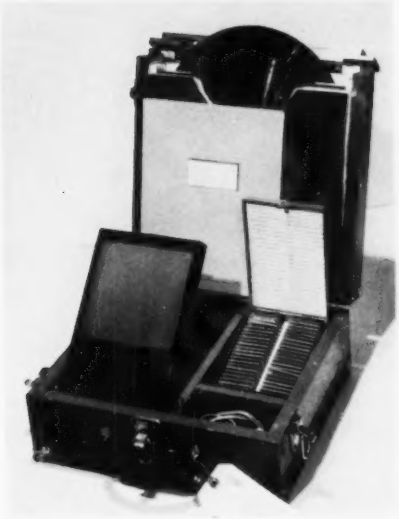


Figure 1 (b).

suitable for the 33⅓ r.p.m. records. These kits were prepraed with the aid of a grant from the Utah State Medical Association and a similar grant from the W. K. Kellogg Foundation. Initially the kits were made available only to the physicians in Utah without charge, however, since July 1, these kits have been released to physicians throughout the United States, Canada, and Mexico for a minimal charge and freight costs.

In preparing the kits, a technique was used which is similar to the one which I am utilizing at the present time, that is, the physician recorded his discussion initially on tape giving the proper cues for slides when they were to be presented. Following this initial recording, the discussion was transferred to long-playing records. The slides used in the kits were prepared by standard techniques.

Use of the audio-visual kits has been somewhat limited to date, but the reception by those physicians who have utilized this method has been enthusiastic. The second slide (Fig. 2) shows a brief summary of the number of physicians using the four kits released to date. As you will note, the second kit, "Radiologic Examination of the Chest" was used by 277 physicians. This particular kit was circulated through a large number of medical schools cooperating in the *Audio-Visual Circuits of the Association of American Medical Colleges* and accounts for the large number of viewing physicians. This tabulation does not include circulation of the kits outside of the state of Utah, but to date physicians in ten states and twenty physicians in Mexico have viewed one or more of these four kits.

These A-V kits have been used by the individual physician in his office or in his home, by small groups of physicians at medical meetings, and some have been presented in the smaller hospital staff conferences. Although the experience with the kits has been limited, most of the physicians feel that the material pre-

AUDIO-VISUAL SEMINAR KITS

KIT NUMBER		PHYSICIANS VIEWING KITS
1	THE RELIABILITY OF RADIOLOGICAL DIAGNOSIS	27
2	RADIOLOGIC EXAMINATION OF THE CHEST	277*
3	LESIONS OF THE CERVIX AND VULVA	87
4	THE ROLE OF THE BLOOD SMEAR IN HEMATOLOGIC DIAGNOSIS	15

Figure 2.

sented is of definite educational value and feel that the opportunity to see and hear such a medical discussion is very beneficial.

On September 15, three new kits will be released for circulation. The subjects to be covered include "The Surgical Treatment of Varicose Veins", "The RH Factor", and "Polyposis and Carcinoma of the Colon". We at the University of Utah are indeed enthusiastic about this form of postgraduate medical education and intend to continue producing these kits primarily for the physicians in Utah but for all physicians interested in this method of continuing their medical education.

The second audio-visual method utilized to bring postgraduate medical education to the home of the physician was *Postgraduate Television Clinics*. Television has been used in medical education but has been limited to closed-circuit telecasts at medical conventions, medical schools, and more recently closed-circuit telecasts to medical centers in several Eastern cities. Regular commercial open-circuit television seemed to be an effective medium to reach a large number of physicians. Recognizing that there might be certain problems relating to the lay audience in medical television, we felt that the potentialities for this medium for postgraduate medical education were great enough to justify presentation of a series of medical clinics designed for physicians only. A series of four medical clinics were designed and television time and facilities were made available without charge by Mr. G. Bennett Larson of KDYL-TV, an NBC affiliate in Salt Lake City, Utah. This venture was supported in part by a grant from the W. K. Kellogg Foundation and was heartily endorsed by the Utah State Medical Association. The clinics were televised direct from the amphitheater at the Salt Lake General Hospital at 7:00-8:00 A.M. on Tuesday mornings. This time seemed to be most convenient for the busy practitioner and was a time two hours before regular telecasting began in the Salt Lake Area. The 700 physicians in the area of KDYL-TV reception were sent advance notices of these telecasts and received reminders prior to each clinic presentation. There was no public announcement of these early morning medical clinics. In November of 1953 the first of these clinics was televised over the regular commercial channel and Slide 3 (Fig. 3) shows the introduction of the clinic on "Congenital Heart Disease". As you can see,

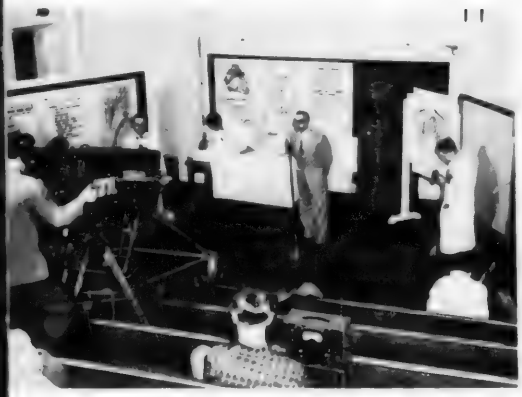


Figure 3.

Figure 4.

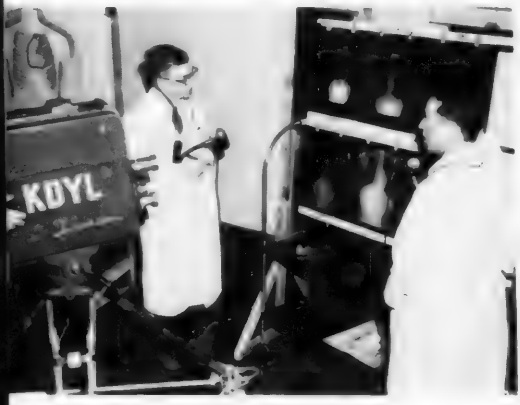


Figure 5.

Figure 6.

we utilized many printed charts and x-rays, and to the right of the slide you can see the electron electrocardioscope which was used for televising heart sounds with both the audio sound and the visual continuous sound tracing. This particular clinic consisted of a discussion and a demonstration of the clinical approach to the diagnosis of congenital heart disease. In Slide 4 (Fig. 4) we see the electrocardiographic leads being connected to our young patient for the purpose of televising a continuous electrocardiogram from the screen of the electron electrocardioscope. In Slide 5 (Fig. 5) we see Dr. Hans Hecht, cardiologist, and Dr. William R. Christiansen, radiologist, discussing a group of x-rays demonstrating various congenital abnormalities of the heart. In our experience we found that X-rays were one of the most suitable visual aids for medical television. In Slide 6, (Fig. 6) we see the remote control unit of KDYL-TV and if one looks closely you can see a chest X-ray being transmitted on the monitor set near the clock.

Since these telecasts represented the first use of open-circuit commercial television for medical education, a program

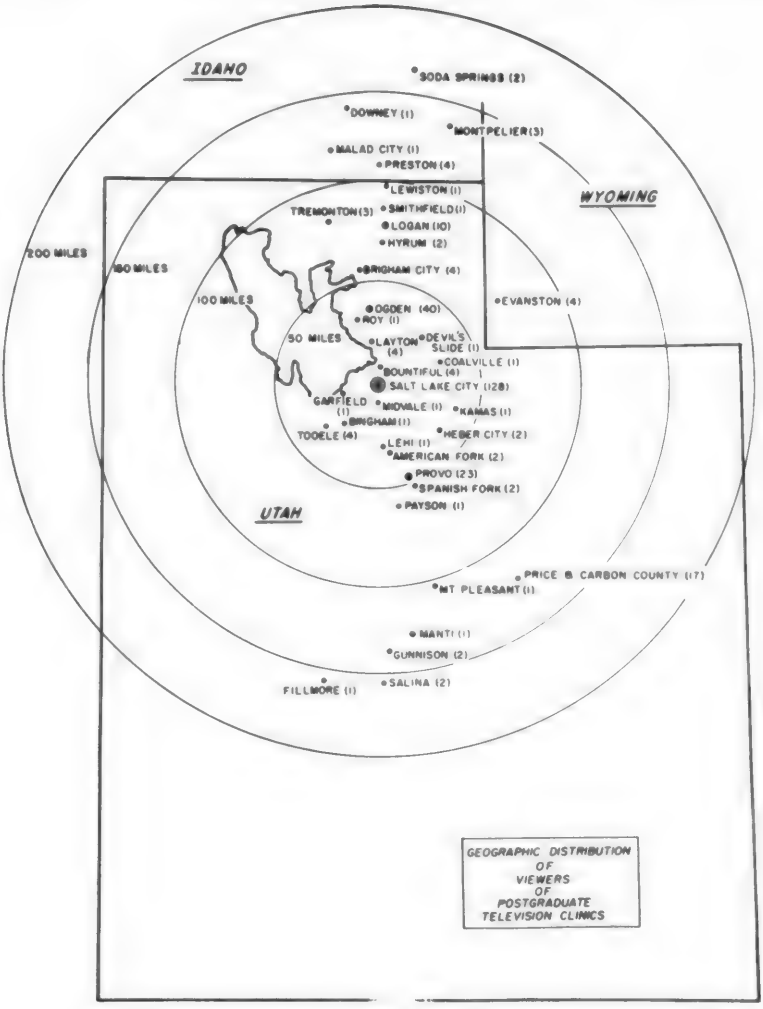


Figure 7.

of evaluation was designed prior to the telecasts. Each of the 700 physicians within the area of TV reception received questionnaires by mail and, upon completion of the series of telecasts, each physician was interviewed by a person to person phone call. During this long distance phone interview, the physician was asked about his participation in *Postgraduate Television Clinics*, and was asked to give his reactions to the various phases of the program and to the idea of utilizing open-circuit television for postgraduate medical education.

Slide 7 (Fig. 7) shows a map of the state of Utah, part of Idaho, and one

POSTGRADUATE TELEVISION CLINICS

ATTENDANCE
SERIES I
(NOVEMBER - DECEMBER 1953)

	VIEWERS %	VIEWERS NO.	NON-VIEWERS %	NON-VIEWERS No.
CLINIC #1 - ABDOMINAL CALCIFICATIONS	21.3	149	78.7	551
CLINIC #2 - G-I BLEEDING	27.7	194	72.3	506
CLINIC #3 - CONGENITAL HEART DISEASE	31.6	221	68.4	479
CLINIC #4 - DIAGNOSTIC CLINIC	25.6	179	74.4	521
TOTAL PHYSICIAN ATTENDANCE		743		
TOTAL PHYSICIANS VIEWING ONE OR MORE CLINICS	48.9	342	51.1	358

Figure 8.

corner of Wyoming, giving the number and geographic distribution of physicians viewing the first series of telecasts. One can see that physicians 175 miles from Salt Lake City were able to view these medical TV programs.

Slide 8 (Fig. 8) shows the summary of attendance to the first series which was televised in November and December of 1953. One can see that from 21 to 31% of the physicians in the area of TV reception listened to each clinic and 342 physicians or 48.9% of the physicians in this area saw one or more of the early morning telecasts. The total physician attendance for this first series of four medical telecasts was 743. This figure does not seem large, but when one compares it with the total attendance to the postgraduate medical courses conducted at the medical school, which was 338, it is obvious that more physicians can participate in the televised form of postgraduate medical education.

On Slide 9 (Fig. 9) you can see that by geographic distribution we found 48% of our audience made up of physicians within Salt Lake County. This group of physicians has the facilities of the medical school available and it is very easy for them to participate in many of the medical school activities. The group outside of Salt Lake County made up 52% of our audience and represented 60.5% of the physicians residing outside Salt Lake County but within TV range in the states of Utah, Idaho, and Wyoming. As to the field of medicine the viewing physician pursued, we found that the general practitioner made up 51% of our audience and this represented 51% of all the general practitioners in the area of TV reception. The specialist made up 49% of our audience and this represented less than half of the specialists in this area. Other ques-

COMPOSITION OF PHYSICIAN AUDIENCE

SERIES II

GEOGRAPHIC		
SALT LAKE COUNTY	40%	(22.4)
OUTSIDE	60%	(40.9)
FIELD OF MEDICINE		
GENERAL PRACTITIONER	66%	(39.4)
SPECIALIST	34%	(21.4)

Figure 9.

REACTIONS OF PHYSICIAN AUDIENCE
75% GAINED NEW MEDICAL FACTS
66% PREFERRED TV MEDICAL CLINICS
5% OBJECTED TO MEDICAL TELEVISION
Figure 10.

tions were asked during this telephone interview survey and some of the more pertinent facts that were gained can be seen on Slide 10 (Fig. 10). 75% of the physicians viewing one or more of these medical telecasts felt that they gained some new medical facts from the clinic. When asked what form of postgraduate medical education they preferred 66% of the viewing physicians felt that the early morning TV clinics were most preferable to them. Interestingly enough only 5% of the 700 physicians contacted objected to open channel medical television. The reasons for this objection were somewhat varied but ranged from disliking the public access to medical clinics to the feeling that television was a poor medium for medical education. Also during these medical telecasts routine surveys were carried out in an effort to determine how many lay people tuned in these telecasts either by accident or by learning of them through conversations at the medical school. Three surveys were conducted, and as can be seen on Slide 11 (Fig. 11) less than 1% of the lay public saw these medical telecasts. It is interesting to note that none of the public viewers offered adverse comment or criticism to the medical profession or the medical school for conducting these early morning medical clinics. Most of the lay people who were contacted after having seen one or more of the telecasts felt that this type of program was good for their physicians but felt that they understood very little of the technical material that was presented.

Because of the enthusiastic reception of the clinics it was felt that further experience should be gained in this type of medical television. Therefore, with the aid of an additional grant by the W. K. Kellogg Foundation, a second series of four clinics was designed for presentation over open-circuit television. It was planned that this series of telecasts would be kinescoped and that after the initial telecast was completed, they would be made available to other medical groups and TV stations. Several new features were added to this series of telecasts, one of which was the TV syllabus which was sent to the physician prior to the fourth clinic on "Rheumatic Fever". This syllabus contained an outline of the clinic material to be presented and summaries of several pertinent discussions on rheumatic fever. In April, 1954 the second series of telecasts were broadcast direct from the Salt Lake General Hospital by use of remote control facilities, again generously furnished by KDYL-TV.

Slide 12 (Fig. 12) shows the "Tumor Conference" which was presented in this series of telecasts and you will note the chart which is being televised is in a somewhat different form than those seen in the previous slides. Upon the advice of Mr. Garnet E. Garrison, Professor of Speech, in charge of the University of Michigan Television Center, charts were designed using black, white, and greys on a cardinal red background. Slide 13

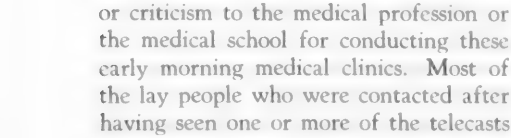


Figure 11.

Figure 12.

(Fig. 13) shows a close-up of a chart showing diagrammatically the surgical exposure for a radical mastectomy. We found that this type of chart televised much better than the black on a frost grey background. Slide 14 (Fig. 14) shows another chart used in the tumor conference and this particular chart seemed to be quite successful in our medical telecasts. You will note the black ovals which represent lymph nodes. These were prepared on gummed paper and were placed on the chart while the pathologist was discussing the extension and spread of carcinoma of the breast. The large cross-hatched circles, also prepared on gummed paper, were placed on the chart to represent the distant metastases which occur in carcinoma of the breast. Other charts used in the telecast contained moving parts and we found that any speaker using a form of moving chart was much more effective in his TV presentation. With the second series of telecasts completed, an evaluation again was carried out by mail and telephone surveys. Slide 15 (Fig. 15) shows the summary of attendance. You will note that the total number of physicians viewing one or more clinics decreased

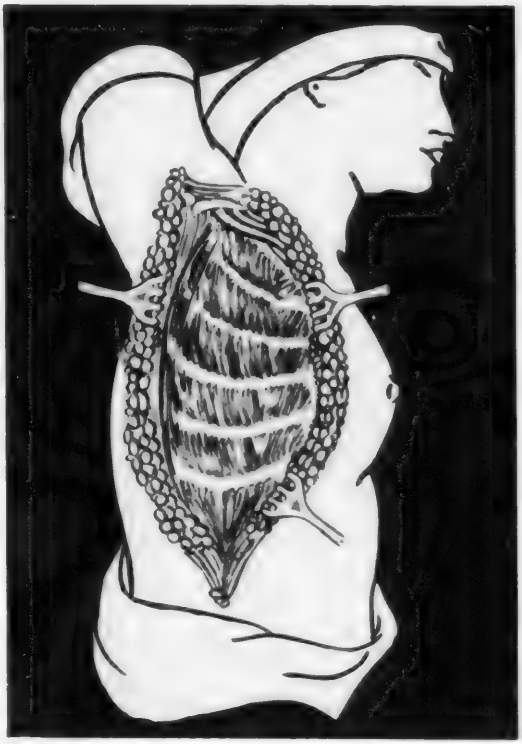
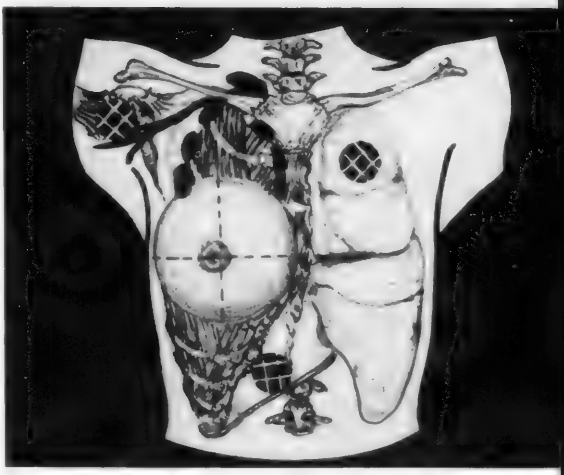


Figure 13.

Figure 14.



POSTGRADUATE TELEVISION CLINICS

ATTENDANCE
SERIES II
(APRIL - MAY 1954)

	VIEWERS %	VIEWERS NO.	NON-VIEWERS %	NON-VIEWERS NO.
CLINIC #1 - COMMON OBSTETRICAL PROBLEMS	14.0	98	86.0	602
CLINIC #2 - A TUMOR CONFERENCE	16.6	116	83.4	584
CLINIC #3 - INFECTIOUS HEPATITIS	15.3	107	84.7	593
CLINIC #4 - RHEUMATIC FEVER	17.7	124	82.3	576
TOTAL PHYSICIAN ATTENDANCE		445		
TOTAL PHYSICIANS VIEWING ONE OR MORE CLINICS	30.8	216	69.2	484

Figure 15.

from 48 to 31% and the reason for the decrease in audience size is probably due to the fact that the novelty of the medical telecasts had worn off and also that many physicians in Utah were on vacation during the time of presentation. In evaluating the composition of the audience we see on Slide 16 (Fig. 16) that the physician outside of Salt Lake County, that is, the physician who had no immediate access to the many facilities of the medical school, made up the greater part of our audience and again the general practitioner viewed the telecast more frequently than his specialist colleague. The mail questionnaire received by the physician at the end of the second series of medical telecasts contained a section with a brief quiz on each of the four clinics presented. All physicians were asked to answer these questions whether they had viewed the clinics or not and tabulations of the quizzes were made using machine methods. Slide 17 (Fig. 17) shows the telequiz summary from the mail questionnaires. You will note that on the first, third, and fourth clinics the percentage of correct answers was much greater for the viewers than those given by the physician who did not see the medical telecasts. In the second clinic quiz, the per cent of correct answers was essentially the same for the viewing and non-viewing physician. This can be explained by the fact that the material presented in the second telecast was more or less common knowledge while newer medical facts were discussed on the other three clinics. We feel that this data in-

COMPOSITION OF PHYSICIAN AUDIENCE

SERIES I

GEOGRAPHIC		
SALT LAKE COUNTY	48%	(40.5%)
OUTSIDE	52%	(60.5%)
FIELD OF MEDICINE		
GENERAL PRACTITIONER	51%	(51%)
SPECIALIST	49%	(46%)

Figure 16.

TELE-QUIZ SUMMARY

SERIES II - UTAH

	VIEWERS			NON-VIEWERS		
	TOTAL ANSWERS	CORRECT ANSWERS	% CORRECT ANSWERS	TOTAL ANSWERS	CORRECT ANSWERS	% CORRECT ANSWERS
COMMON OBSTETRICAL PROBLEMS	122	95	77.8	272	147	54.0
TUMOR CONFERENCE	116	90	77.5	240	197	81.0
INFECTIOUS HEPATITIS	101	62	62.3	208	101	48.8
RHEUMATIC FEVER	125	96	76.8	221	102	46.1

Figure 17.

Figure 18 (below).

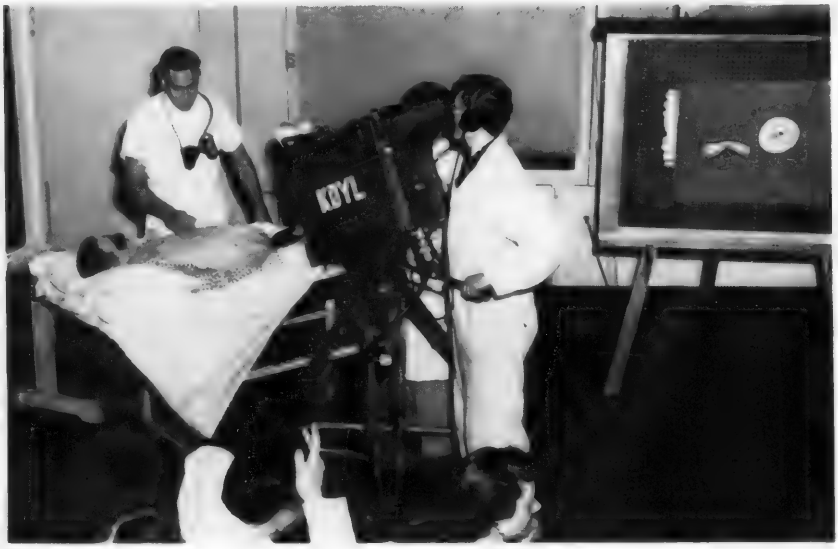


Figure 19.

dicates that those viewing the medical telecasts gained new medical facts from the programs, and that our postgraduate television clinics have a definite educational value. As I mentioned before, the second series of telecasts were kinescoped so that they might be televised in other areas. During the summer the kinescoped clinics have been televised in Yuma and Tucson, Arizona, and Spokane, Washington. Complete evaluation of the physician audience in these areas is being carried on at the present time. Reception of the kinescopes in these other areas has been considered good, and the physicians viewing the clinics have been enthusiastic about this type of postgraduate medical education.

On Slide 18 (Fig. 18) you see the equipment which was used for recording these clinics on film. The film copies were made at the hospital from the live telecasts using an Auricon Super 1200 camera with a TVT shutter, instead of the usual kinescope apparatus. Slide 19 (Fig. 19) shows a physician demonstrating physical findings on a patient before the television camera. This shot will be seen on the copy of the kinescope which I have prepared from the third clinic on "Infectious Hepatitis". I have a ten minute presentation from this third clinic which was kinescoped by the technique mentioned, and I hope that you will remember when this is projected that much of the quality is lost when kinescopes are projected to a large size. I hope that this presentation of the two new audio-visual methods in postgraduate medical education which have been developed during the past year at the University of Utah has been of some value to you and I am sure that if you have any questions on either the *Audio-Visual Seminar Kits* or *Postgraduate Television Clinics*, Mr. Tribe will be happy to answer them. And now to take a look at the sample of the kinescoped postgraduate television clinics.

Thank you.

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A Copy-Stand Used In Making Microfilm Negatives of Books*

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Introduction

THE copy-stand described here was designed for the use of the Section of Photography and Illustration, a part of the Library of the Division of Laboratories and Research. Publication and Museum Department. Because of the nature of the work performed by the Division of Laboratories and Research, photographic copies of printed matter are often urgently needed. By a special adaptation of routine facilities, a highly successful and economical photoduplicating service has been established.

Herman Fussler in his book, "Photographic Reproduction for Libraries"[1], writes:

> " . . . *Enlargement printing from microfilm makes possible the production of positive-paper prints at costs approximately equal to or less than the costs for negative photostats. This is largely because of the economy in material in the negative at the reduced size on film instead of full size on paper, because of greater copying speeds, and because less expensive papers can be used in many instances for enlargement printing than are required in the original photocopying machines . . .* "

Judging by my own experience this is a conservative estimate. Considering materials alone, an 8 in. x 10 in. print can be made for about six cents. The cost of materials is obviously not the entire story. This presentation, then, is concerned with reducing the photography of books to simplest terms. A unique opportunity is open to the photographer in a scientific institution to initiate such a service for the staff or library. The initial investment is modest. Beyond the purchase of a microfilming camera and the cost of constructing a simple wooden stand, everything that is used in this work is part of the normal equipment in a photographic department.

Design

In the design of the stand (Fig. 1) each variable is standardized to secure speed in operation and uniformly sharp negatives. Essentially, the stand is a device for securing a flat page without straining the binding of the book being photographed.

A description of the copying procedure will best demonstrate the functional details of the design.

The camera, loaded with *Microfile* film, is attached with a screw into its tripod fitting, to a shelf at the top of the stand. The shelf slides in tracks inclined at a 45° angle. A counterweight

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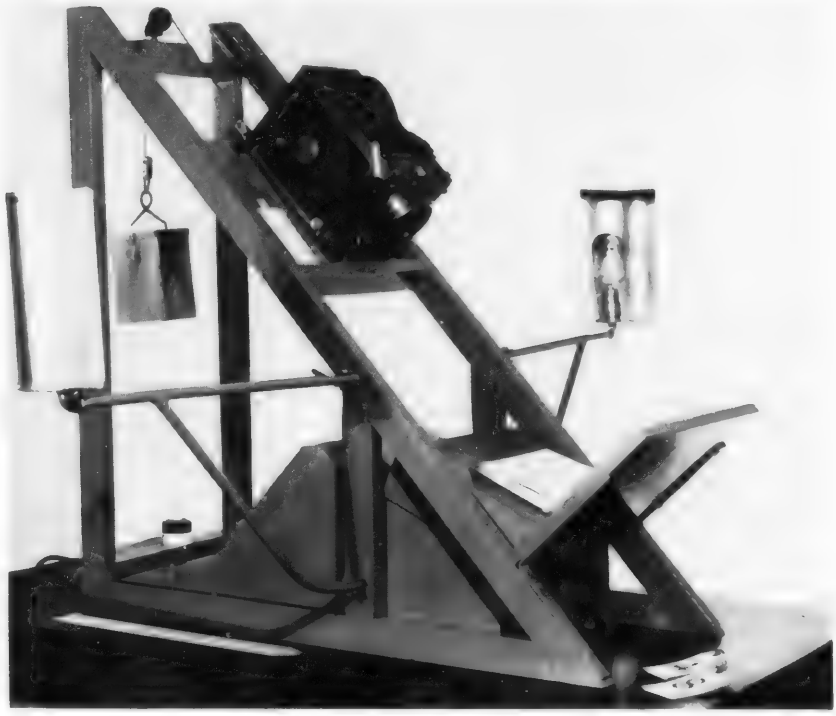

Figure 1. Book copy-stand ready for use.

operating over a grooved caster balances the camera so that the friction of the track alone maintains its position. A run of eight inches with a stop at the forward end of the track is provided. Figure 1 shows the stand with a *Parvo-Debrie Model L* 35mm motion picture camera in place of the usual microfilming camera. The camera is taken to the darkroom at the end of each day's operation and the exposed film is removed. A fourteen frame leader is turned at the end of the day's run to allow cutting beyond the last sprocket and threading the camera only once for each 100 foot roll of film. Mounting of the camera, whatever the type, must have the center of the lens perpendicular to the center of the easel as seen in Figure 2(A).

The open book is placed on the easel in a cradle formed by the easel (A) and the supporting blocks (B) and (B'). Since this cradle can be raised or lowered by the wedge-like action of the block, the book can instantly be centered on the easel. The cradle automatically squares the book binding in relation to easel and camera, so that images on the film are never askew, even though the image is never sighted through the camera.

All copying is done at a set ratio of 1 : 12 so that the focus, once set, remains constant. The camera is focused sharply on the easel and the focusing lever secured. The distance from lens to book is kept constant by backing the camera in its track for books thick

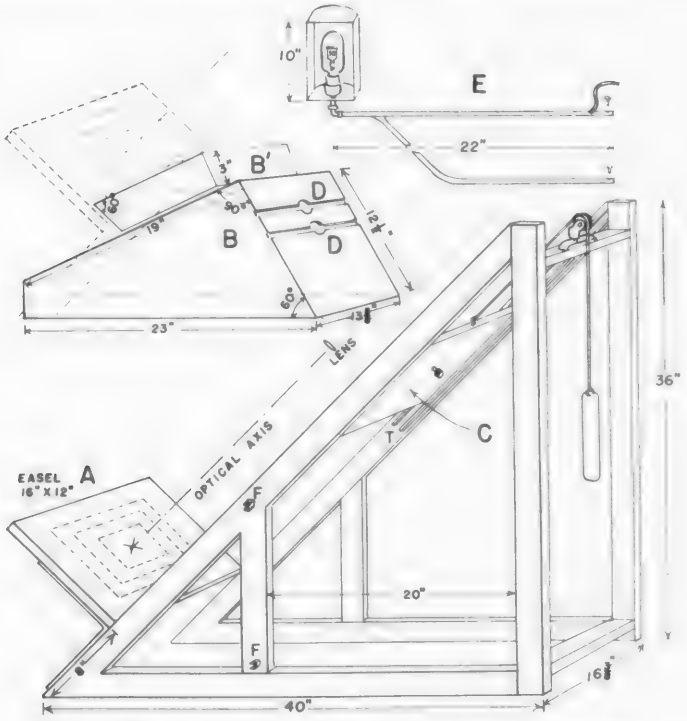

Figure 2. Perspective drawing of structural details of copy-stand.

enough to make a significant change in the distance. At no time is this adjustment critical enough to warrant checking the focus at the focal plane. The depth of field is known and is sufficient, even at full aperture. The results, as seen in Figure 3, bear this out.

Glass for weighting pages is seldom necessary, or a black paper shield for preventing reflections from the facing page. This results from the angle of the cradle. At 90° (± 10°) the page to be photographed lies flat. The angle of the cradle was made at 105°, the supplement of the combined 30° slope of the box and the 45° slope of the easel. This angle eliminates reflected light from the facing page so that even illumination may be more easily attained. The book, by merely being opened in the cradle, is ready for photographing.

Two hinged arms carrying the lamps, swing from a folded position to stops equidistant from the center of the easel, thus allowing the light to reach the book from a 45° angle. The position of the lamps allows easy access to the book by the operator.

Before proceeding with the copying, large numerals printed on cards (extreme right in Figure 1) are photographed. The numbers are easily seen after the film is processed, and are used for identification and filing when the short strips are assembled in a roll.

Copying proceeds as rapidly as pages can be checked and turned. The book remains in place: the only motion is the

turning of pages. In this manner, all the even numbered pages are photographed, then the book is turned and the odd numbered pages treated similarly.

The day's run of film is processed in one operation using conventional methods. *Kodabromide A-2* and *A-4* are used for printing. Negatives are made to permit the most rapid printing rather than for extreme contrast. Hypo baths deteriorate rapidly since so much of the silver salts is removed in the fixing of the prints. The prints are processed by conventional methods.

Figure 2 shows sufficient structural detail for a carpenter to work with. The frame of 2 in. x 1¼ in. pine consists of two 45° triangles joined by three cross members and the easel which serves as the fourth, as may be noted in Figure 1. Since the large triangular box B must slide under the easel, there can be no cross member at this point. The easel is made of plywood 16 in. x 12 in. x ¾ in., and is set 8 inches from the lower point of the triangle 6 inches above the table.

The triangular box which operates with the easel to form the adjustable height cradle is a hollow box, the shape of which, seen from the side, is a 30°–60°–90° triangle with the 30° angle cut so that it does not project beyond the easel. In width, this box fits inside the frame, resting on the table. The dimensions are given in Figure 2. Quarter inch plywood is suitable for this box and the small one (B′) that rests on top of it and transfers the movements of the lower box to a higher level on the easel. Aside from the 60° angle bearing on the easel, this is a rectangular box.

The camera shelf (C) slides in grooves (T) which can be made from corner molding nailed in place. A cross member has been omitted from the drawing to show the track. No measurements have been given for this piece since it must be placed to suit the forward focus position of the particular camera. This bar, shown in Figure 1, is important since it indicates the point from which the eye estimates the distance the camera must be withdrawn to accommodate book thickness. Figure 2 (E) shows one of the pair of hinged arms which support T-20 projection lamps 22 inches from the frame. The galvanized metal reflectors are 10 in. high, and 6 in. deep. It is this depth and the lens hood which keep the light under control. The rack (DD) is for the storage of glass plates for flattening the pages when necessary.

Figure 3. Enlargement of microfilm negative.

Summary

A device and technique are presented for the rapid photographing of books on microfilm for the production of 8 in. x 10 in. prints at very low cost.

REFERENCE

1. Fussler, Herman H.: Photographic Reproduction for Libraries. A Study of Administrative Problems. Chicago, Univ. of Chicago Press, 1942, p. 192.

Ground Glass Modification for Photomicrography*

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WHEN making photomicrographs, magnifications greater than 100x usually result in difficult focusing, as the image on the ground glass is indistinct and partially dispersed by the roughened glass surface. This is particularly annoying when viewing a small image in a small camera. Owners of cameras with ground glass backs have used a special viewing spot on the ground glass, made by adding a small drop of oil or glycerine to the center of the glass. A round, thin glass cover-slip can be cemented to the ground surface for better results in dim light. Attention has been called to the use of the latter method in photomicrography.[1]

On special order, at least one manufacturer of a single lens reflex miniature camera now furnishes a ground glass with a center spot left clear for occasional photomicrographic use.[2] When used exclusively for photomicrography the entire focusing screen is left clear. This special viewing screen can be used as an interchangeable accessory.

Owners of earlier models of this or other single lens reflex cameras can produce their own small clear spot for making photomicrographs. Commercially available cover-slips are too large, but they may be cut down to the proper size by using a metal tube as a hollow drill. Asphaltum varnish, sealing wax, balsam or other soluble material can be used to cement the large cover-slip to a flat surface and this will hold the thin glass for cutting discs of suitable size. Automobile valve-grinding compound or other abrasive in oil, glycerine or water can be used with the hollow drill for grinding through the glass.

An easier method of making a small disc is to use thin plastic or celluloid sheets and a sharp paper punch that will punch out a disc of the proper size. The 5mm disc in figure 1 was made this way. Balsam or any of the new, faster-drying cover-slip cements can be used for cementing the glass or plastic disc to the center of the ground glass surface.

Figure 1. A 5mm plastic disc punched from sheet plastic and cemented to the ground glass of a single lens reflex 35mm camera enables easier focusing at high magnifications.

If the focusing glass cannot be lifted out of the camera, the disc can be inserted through the front of the camera after the lens mount has been removed. The front-surfaced mirror must not be touched, as the coating is easily marred. Inverting the camera and using cover-slip forceps will permit easier insertion of the disc.

The resulting clear spot is so transparent that it cannot be used for normal focusing with the camera lens because an aerial image is produced and nearly all images seen through it are in sharp focus. The increased brightness of the image is of benefit in dim light or when the diaphragm is partly closed. When used in photomicrography, the clear disc is especially beneficial while using high magnifications, dark field illumination or phase contrast equipment. Examinations of diatom test slides reveal minute details of the striae in the central clear spot which are not visible in the surrounding ground glass area.

These small focusing discs are also useful when cemented in each corner of the ground glass of large photomicrographic cameras.

* Received for publication September 23, 1954.

REFERENCES

1. Morgan, Willard D. and Lester, Henry M. Graphic Graflex Photography. Eighth Ed., 1947. Morgan and Lester, New York, N.Y.
2. Anon. New Apparatus. Jour. Biol. Photo. Assoc., *19*(3): 141-142, (August) 1951.

Preparing Lantern Slides With "Fototype"*

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THE use of *Fototype*** in the preparation of lantern slides is not new, but for those unfamiliar with its use, the method described in this paper will serve as a guide. Simplicity, speed in setting up, and quality of the finished job make the use of this technique desirable.

Aside from the type itself, the only equipment necessary is a special composing stick, scotch tape, a straight edge, and a small triangle.

Fototype consists of pads of individual letters, punctuation marks, and spaces. These are easily detached from their pads for setting in the self-aligning composing stick.

Copy is prepared as follows: The width of the composing stick is adjusted, a blank space is inserted into the stick which is then further adjusted so that the tab buckles slightly. This spacer later serves as a tab with which to handle the finished line of type. The letters for the first word are selected and placed in position in the composing stick. The author has found that composing individual words in succession is speedy and efficient.

The composing stick is designed with a scale in inches on both the upper and lower retaining bars. These scales provide a ready reference for determining the length of the line of type and also provide a way of checking the vertical alignment of the letters. A blue identification mark on the back of each letter and character assists the composer in proper placement. An experienced operator can set about fifteen characters a minute. Care should be taken to insert blanks at both the beginning and end of each line. These blanks serve to lock in the line and also provide tabs with which to handle the strip. The blue identification markers will not necessarily be lined up even though the characters themselves are in perfect alignment.

To remove the completed line of type from the composing stick, a strip of scotch tape is pressed over the back side of the line. The line can then be picked up, placed face up on a flat surface and burnished to flatten any sharp edges. The author burnishes the type by covering it with a sheet of tracing paper and rubbing, using a vertical stroke with a small triangle. This method is different from that recommended by the manufacturer, but in the experience of this author, it better flattens the tab edges so that no line appears between the letters in the photograph.

After the copy has been set it is mounted on illustration board or similar supporting surface. There are a number of mounting techniques using such materials as rubber cement, mucilage, and double faced scotch tape. Rubber cement is an especially desirable adhesive since it permits easy removal of the type at the end of the job. Common words and phrases may be saved for future use. When this is to be done it is advisable to use masking or drafting tape in removing the characters from the composing stick.

Before beginning the mounting, the final appearance of the slide should be considered. The headings and body copy should be properly spaced and aligned with respect to one another. Only then is it ready for photography.

Whenever possible, the copy should be lit so that the axis of illumination is parallel to the vertical edges of the letters in order to eliminate shadows, and subsequent spotting of the negative. Best results are obtained on films of the litho variety. Exposures may also be made directly on lantern slide plates.

Enlargements of *Fototype* up to four times are possible without any loss in quality. There are at present over 150 different type fonts available including roman, gothic, italic, hand-drawn and sans-serif faces. It is also available in a number of "negative" faces.

The method described is considered by the author to be superior to hand lettering or that made with lettering sets. Line spacing and alignment are done after the type is set. The final product is a legible and professional appearing slide prepared in a minimum amount of time.

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** Manufactured by FOTOTYPE Inc., 1414 Roscoe St., Chicago, Ill.

A Masking Frame for Copying and Combining Radiographs*

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NUMEROUS articles have been published relating to the problems of making copies of radiographs.[1,2,3,4,5] Practical solutions to these problems are important to the medical photographer because a major portion of his time is spent in making prints and lantern slides from radiographs. One must first of all obtain quality, but at the same time increase production efficiency by saving time and materials. We have devised a masking frame for copying and combining radiographs which has proved very useful in meeting these requirements.

The ideal method of masking should make possible the combining of several views on a single sheet of film and the blocking off of any undesirable areas. Figure 1 is a drawing of such a device, based upon the principle of the adjustable metal masking-bands found on contact printers or enlarging easels.

The frame is built of plywood and sheet metal. An opening is provided to fit the outside dimensions of a 14 in. x 17 in. X-ray illuminator, in the center of a 32 in. x 29 in. plywood board of ½ inch thickness.

The face of the illuminator, stripped of protruding objects, is fitted flush with that of the plywood board. It is fastened into position with brackets on the back. Metal strips, 7 inches long, cut from 1/16 in. thick sheet metal, are fastened to sliding members, as shown. All surfaces from the immediate edges of the opal glass of the illuminator, to the extreme edges of the frame, have a dull black finish. Any amount of blocking can be achieved on any section of the illuminator: from the full 14 in. x 17 in. opening to smaller than 35mm size. Flexibility and masking are supplemented by placing the frame against a black background with the bottom edge of the opal glass 4 feet from the floor. The size of the black background should not exceed 6 feet, because if more than a 6 foot background is needed, too many views on one slide have been requested

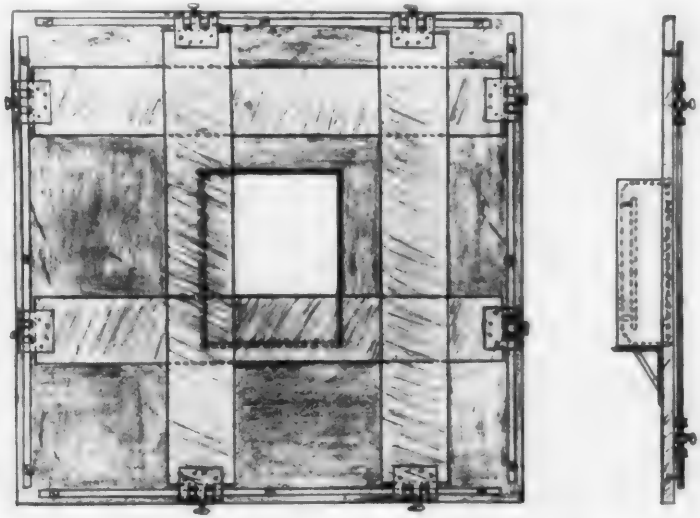

Figure 1. A drawing of the 1st X-ray masking frame.

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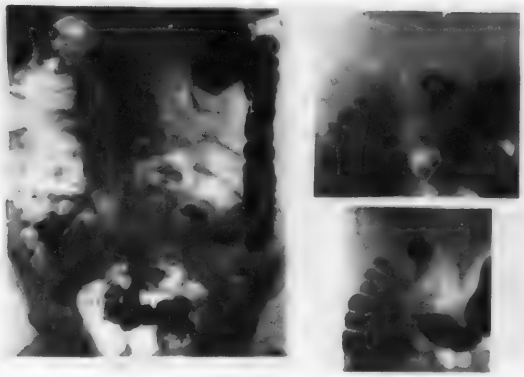

Figure 2. This illustrates a negative with three exposures on a single sheet of film.

Figure 3. This is the positive of Figure 2. Note there is no light spill-over onto the radiographic image.

for good projection practice. This additional background permits a series of exposures. By composing and combining several radiographs one can create many different patterns of various dimensions on a single sheet of film. This is accomplished by increasing or decreasing the distance between the camera and masking frame, by moving from side to side, or by raising or lowering the camera. One *must* outline on the ground glass of the camera, the last exposed area with a wax pencil to utilize the remaining black area for the next exposure. If it is necessary to correct distortion, the side swing and tilt adjustments of the camera can be used.

The need of several views on one slide for comparative purposes is often desired, particularly with radiographs. Physicians become discouraged by the higher costs made for additional views under ordinary methods of masking and combining radiographs. The masking and combining system described reduces the cost considerably, and it soon becomes known that for a slight increase over the price paid for one view, several are obtainable. A sudden rush of work will probably result. However, one should insist on not placing too many views on a single slide.

REFERENCES

1. Maurer, R. E., Yule, J.A.C., and Cornwell, W.S. A Masking Technique for Making Radiographic Paper Duplicates. Medical Radiography and Photography, Vol. 27, No. 4, 1951.
2. Snalen, Albert. A Variable Control X-ray Illuminator and Copy Stand. J.B.P.A., 17: No. 4, 1949.
3. Gibson, H. Lou. Black and White and Kodachrome Copying of Radiographs. J.B.P.A., 19: No. 2, 1951.
4. Bartlett, Earl C. X-ray Copying with Guesswork. J.B.P.A. 21: No. 1, 1953.
5. Perry, Wm. E. Planning the Radiograph Copy Negative. J.B.P.A., 22: No. 1, 1954.

New Tasks For Photography In Spectrophotometry*

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SPECTROPHOTOMETRY plays an important role in biological research. Numerous substances and compounds of great biological importance can be identified by their spectrophotometric characteristics, that is, by their more or less typical absorption curves. Spectrophotometry is frequently performed with such substances as polynucleotides, proteins containing cyclic amino acids like tyrosine, tryptophane and phenyl alanine, several steroid hormones, and many others.

Until just a few years ago the usual way of determining absorbing materials in histological specimens was to make spectrophotomicrographs. With this technique several photomicrographs are made with different wave lengths of light, generally with a reflecting microscope or one with quartz optics. The photomicrographs, exposed with monochromatic radiation, show different densities within individual details, these details being different in relation to the different wavelengths used. By comparison or by means of densitometric measurements the investigator is able to set up extinction diagrams from the different photomicrographs and thus determine the amounts of absorbing material in the tissue.

The further progress in spectrographic investigation methods led to the use of photoelectric and electronic equipment. Most workers now make use of electronic spectrophotometers which consist of a radiation source, a monochromator, a radiation detector, generally a photocell or photomultiplier, and the necessary electronic amplifiers and meters for reading the results. The *Beckman DU* photometer in the United States and the *Zeiss* ultraviolet spectrophotometer in Germany are probably the best known instruments of this kind. Working with equipment of this kind is very easy and convenient. Since these instruments have become readily available, the importance of photography in spectrometric work has become less.

Recently, however, photography has been given new tasks. The carrying through of a photometric measurement takes some time, several minutes as a rule. Because some biological compounds are very sensitive to ultraviolet radiation it is a problem of general biological interest as to whether the ultraviolet absorption properties of compounds such as proteins and polynucleotides really exist or if these properties are due to some alteration or damage to the cell by the ultraviolet radiation.

As previously mentioned, each photoelectric spectrometric determination requires a circumscript time. This time is associated with the construction and design of the recording equipment. Even self-recording spectrophotometers require appreciable time for measurement through the desired spectral range. This time may be sufficient to bring about alteration in the material being studied. A new method for obtaining ultra-short time recording of absorption effects uses a cathode ray oscilloscope. In combination with a spectrophotometer the time required for obtaining a measurement can be reduced to a second, or less. During this time, measurement can be made through the entire visible and ultraviolet range of the spectrum. Since most cathode ray oscilloscopes have built in amplifiers, sufficient amplification is easily attainable. Possible alteration or damage to the material by ultraviolet radiation is reduced to a real minimum. The absorption curves appear on the screen of the oscilloscope. Since these phenomena are transient, it is necessary to record them photographically. With this in mind, I should like to call attention to another field of activity for the biological photographer.

An example clearly illustrates the kind of result obtainable. Figure 1 shows an extinction curve for the dye thionine, sometimes used in histological techniques. This curve was made in the ordinary way by electronic spectrophotometry. Several minutes were required to record the necessary data. Figure 2 shows the extinction curve for the same material as produced on the screen of a cathode ray oscilloscope, recorded photographically. The bright area at the top of the figure represents the pure emission of a low

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voltage lamp after passing through the standard. Comparison with the absolute spectral distribution of the energy, demonstrates the similarity between the dark portion in the middle of the field, and the absorption curve (Figure 1) prepared by the more usual method. While the sharpness and accuracy of the oscilloscopic result may be somewhat less than a photoelectric absorption curve, the characteristic form is sufficiently close.

The most important advantage of this technique is that oscillographic and photographic recording of absorption phenomena can be performed in far less time than by photoelectric measurement and visual observation. Alteration of living material can be avoided with reasonable certainty.

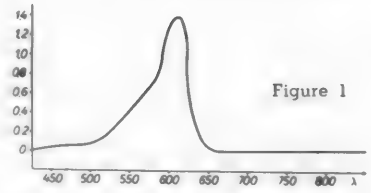

Figure 1

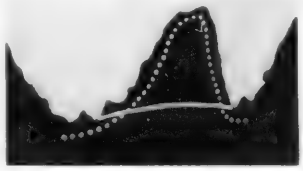

Figure 2

Enlarged Display Transparencies In Color—Modification of the Flexichrome Process*

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THE *Flexichrome* process enables any worker to make large color transparencies from black-and-white or color films for shadow box displays. The modifications which have been worked out by the author omit several of the more tedious steps in this procedure.

The original process calls for the printing (through the base) onto the *Flexichrome* stripping film, development, fixing, warm water wash to produce a positive gelatin relief image, and then the stripping of the emulsion from its base and transferring it to a previously prepared support. The stripping and transfer operations are fraught with danger and require a certain amount of skill and experience. These are the operations which are omitted in the modified process and this is possible by the use of *Kodak Matrix Film* instead of the *Flexichrome* stripping film.

No attempt will be made here to acquaint the reader with the *Flexichrome* or the matrix film processes. This information is given in the Kodak publications "Color Prints with the Flexichrome Process" and "Color Prints with the Kodak Dye Transfer Process". This latter publication is not absolutely necessary. One has only to substitute matrix film for *Flexichrome* film in the first publication and proceed with the following steps in order:

1. Exposure—through base of matrix film
2. Develop—great latitude in contrast control
3. Fix—2 min. in 2% acetic acid
4. Hot water rinse—undeveloped emulsion removed to form a positive relief image
5. Cold water rinse—this chills the very soft emulsion
6. Modeling agent—forms a key image
7. Rinse—1 to 2 min.
8. Dry
9. Color—*Flexichrome* dyes applied by brush

By using *Kodak Matrix Film* instead of the *Flexichrome* film one can produce a positive relief image directly upon a suitable support which, when dry, is perfectly flat and ready for coloring.

The bleach bath in the original process is omitted to increase tonal scale.

The same developer (Tanning developer A & B) is used for both the *Flexichrome* and matrix film. The proportion of the A and B parts of this developer control the contrast over a wide range.

This same technique obviously cannot be used with *Flexichrome* film.

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Correlation Between Resolving Power, Magnification and Illumination in the Microscope*

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THE limits up to which the light microscope can reveal details are determined by a number of factors, foremost among which are:

1) Degree of Correction of Optical Aberrations.
2) Resolving Power and Numerical Aperture.
3) Magnification.
4) Visual Resolving Power of the Human Eye.
5) Illumination.

A close look will show that point 1) is beyond the control of the microscopist — he depends entirely on the built-in quality of his equipment.

Points 2) and 3) deal with values which are determined by the design of the optical components of the microscope — hence, determined by the manufacturer. Here we find, however, that only proper use will permit utilization of the optimum. Thus, this part is subject to the user's control.

Correct illumination is one of the most important phases in the proper use of the microscope — and incidentally, *the* one most often misused. This article will, for this reason, elaborate particularly on the subject of proper illumination. We will show how it effects the resolving power of the microscope and thereby also the useful magnification.

The Degree of Correction of Optical Aberrations in objectives, eyepieces and condenser, determines the definition, the crispness and clarity in the image. Obviously, this freedom from aberrations must be built into these components by the manufacturer, as this quality depends on the design, the material, and the workmanship, i.e., factors over which the user has no control afterward. Furthermore, it is imperative that these optical components be kept in perfect alignment. Only a microscope in first class mechanical condition can do so.

Resolving Power is a term used to express the smallest linear separation of two object points which can be distinguished as separated. The measure for the resolving power is the *Numerical Aperture* = N.A. The relation between N.A. and resolving power are expressed in formulas, originally worked out by Abbe. Details are given further along. Again it will be seen that the N.A. of a microscope objective is determined by its design, i.e., it is determined by the manufacturer. It should be understood, however, that the N.A. of an optical system, in itself, does not determine the quality of a lens. Its value becomes meaningless unless supported by a high degree of chromatic and spherical correction and high overall quality of the lens. Furthermore, as will be shown later, the effective N.A. may be considerably less than the maximum rated value if the microscope is not used properly. All factors being equal, however, the resolving power is directly proportional to the N.A., while the light transmission is proportional to its square.

The *Magnification* in the compound microscope is the product of the initial magnification of the objective times the eyepiece magnification. The normal viewing distance of 25 cm is the conventional standard on which the value thus obtained is based. Any object viewed by the naked eye at that distance, is imaged on the retina at a definite ratio. Details in that retinal image must be of a certain size in order to be resolved by the human eye. Thus an object detail must be magnified by the microscope sufficiently to come up to the minimum resolving power of the eye.

However, as we have seen and as we will see in greater detail later, the microscope itself is limited with regard to its own resolving power, governed by the numerical aperture of the objective and the overall quality of its optical components. It follows that there is a definite relationship between N.A. of the microscope objective and total magnification. This value has been found to range between 500 to 1000 times the N.A. of the objective. While it is possible to go beyond these limits of "useful magnification" by the use of high power eyepieces, or by projection, it will now be understood that this will result merely in the formation of a larger image. No new details can be revealed, i.e., we have "empty magnification"! In extreme cases this

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will result in a rapid deterioration of the quality of the image for purely optical reasons.

The *Resolving Power of the Human Eye* has been briefly mentioned in the preceding paragraph. It appears that this point has in the past not received the attention that it deserves, in connection with the microscope. While it was known that a relationship exists between the pupil opening of the eye and its resolving power, it is only of comparatively recent date that exact data has become available. There seems to be general agreement now that the optimum pupil diameter is somewhere between 2 and 4 mm, and that with pupil diameters greater than 5mm, the resolving power of the eye is markedly decreased. (Note bibliography.)

Illumination for the microscope and proper intensity control of such illumination, assumes new importance as a result of these findings. Since pupil diameter is governed by the intensity of the light striking the eye, it is evident that controls should be provided permitting instant adjustment of the intensity to bring about proper balance of the amount of light entering the eye. Ideal conditions prevail if such balanced illumination can be kept nearly constant, regardless of lens combinations in the microscope, or mode of observation, and if the color temperature of the light does not change when the intensity is changed.

While the preceding paragraph deals with the relations between resolving power of the human eye and illumination, we will now consider the even more important relationship that exists between the resolving power of the microscope and the illumination.

As pointed out before, all other factors being equal, the resolving power of a microscope objective is measured by its Numerical Aperture, or N.A., defined in the following formula:

$$\text{N.A.} = \sin u \, n_D$$

where u = half the angle of the cone of light entering the objective,

n_D = the refractive index of the intervening medium (air, immersion oil, water, etc.)

In the formula above, the refractive index of air $n_D = 1$, and since sin u cannot exceed 1.0, the maximum theoretical N.A. of a "dry" objective is 1. In practice however, sin u obviously cannot reach a value of 1.00, but must necessarily be smaller. The maximum attainable value, therefore, is N.A. = 0.95.

Immersion oil has a refractive index $n_D = 1.515$. The maximum theoretical value of N.A. = 1.515. However, again in practice, the maximum attainable value is N.A. = 1.40.

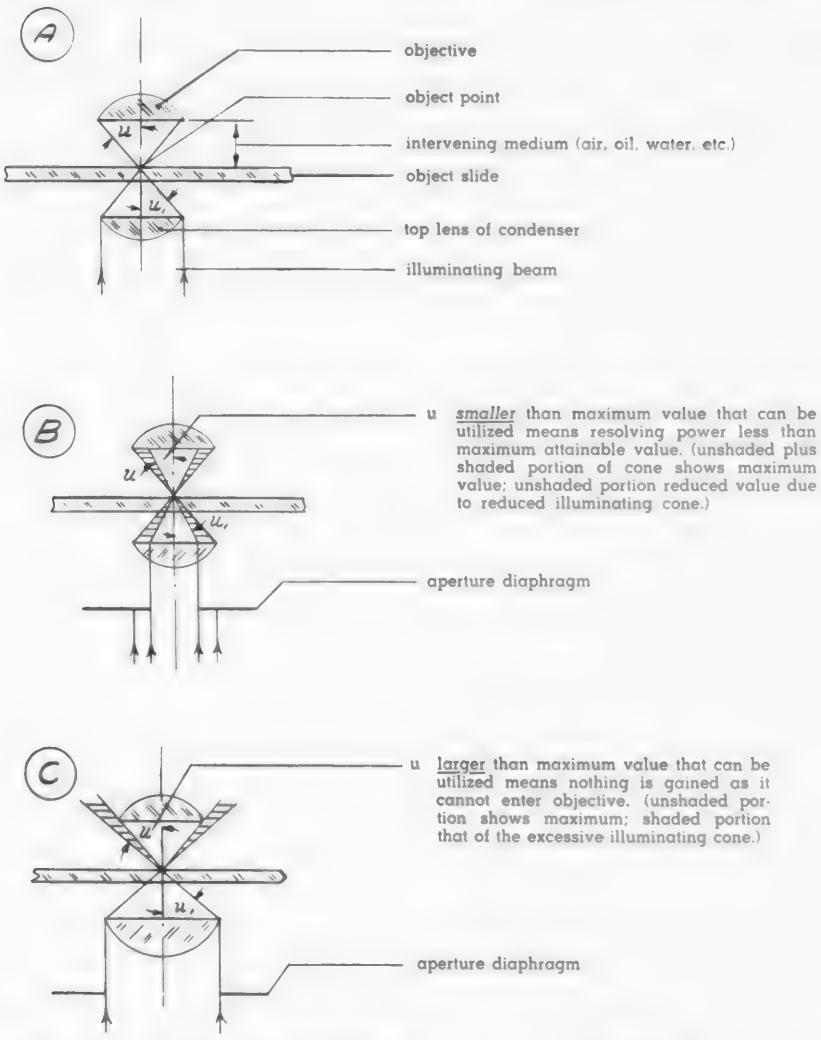
The angular aperture of an objective and its focal length as well as its free working distance are determined by its design, as is the nature of the intervening medium to be used between front lens and object. These constant factors limit the maximum N.A. of the objective; hence, its maximum resolving power. For example, an Apochromatic Dry Objective 10x, N.A. = 0.30 will resolve 1140 lines (white light) per mm, or object points down to approximately .88 microns apart will be resolved; whereas, an Apochromatic Oil Immersion Objective 90x, N.A. = 1.40 will resolve 5330 lines per mm which is equivalent to approximately .19 microns separation.

The above formula and sketch (A) show that these maximum resolutions can be obtained only if angle u reaches its maximum value, and, if angle u_1 of the cone of light emerging from the condenser is equivalent to angle u. *It is also evident that any indiscriminate cutting down of the illuminating cone of light below the maximum cone that can enter the objective (see sketch B) reduces the effective N.A., i.e., its resolving power, in direct proportion while, conversely a larger illuminating cone is of no benefit, (see sketch C).*

Since the iris diaphragm of the substage condenser controls the angular value of the illuminating cone, hence its aperture, it is now clear that it should not be used for regulating the intensity of the illumination because of the associated effects on the N.A., i.e., the resolving power of the objective. Neither should the condenser be "racked down" for that purpose as this practice, likewise, effects the resolving power.

It follows that the intensity of illumination must be controlled by means other than the substage of the microscope, preferably by one built into the illuminator itself. (The use of regulating resistances or regulating transformers is not advisable because of the associated effect of change in color temperature of the light.)

The control means must permit changes within wide margins if our aim is to be fulfilled, to deliver light of specific N.A. to the microscope objective and of approximately constant intensity to the eye. Light requirements naturally change whenever lens com-


A
objective
object point
intervening medium (air, oil, water, etc.)
object slide
top lens of condenser
illuminating beam
B
u smaller than maximum value that can be utilized means resolving power less than maximum attainable value. (unshaded plus shaded portion of cone shows maximum value; unshaded portion reduced value due to reduced illuminating cone.)
aperture diaphragm
C
u larger than maximum value that can be utilized means nothing is gained as it cannot enter objective. (unshaded portion shows maximum; shaded portion that of the excessive illuminating cone.)
aperture diaphragm

Figures (A), (B) and (C). For explanation see text, and data accompanying each figure.

binations are changed: a low power combination less than an oil immersion; a binocular body tube more than a monocular; darkfield or phase contrast microscopy considerably more than brightfield, etc. The ratio of these intensity requirements range between 1 and 100.

BIBLIOGRAPHY

"Physical and Photochemical Basis of Visual Resolving Power. Part 1. The Distribution of Illumination in Retinal Images," by George M. Byram, J. Opt. Soc. Am., 34:571, 1944.

"The Coefficient of Specific Resolution of the Human Eye for Foucault Test Objects Viewed Through Circular Apertures," by Coleman, Coleman, Fridge and Harding, J. Opt. Soc. Am., 39:766, 1949.

"Photographic Granularity and Graininess, III. Some Characteristics of the Visual System of Importance in the Evaluation of Graininess and Granularity," by Loyd A. Jones and George C. Higgins, J. Opt. Soc. Am., 37:217, 1947.

The Preparation of Two Dimensional Illustrative Material For Photography*

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Introduction

MUCH of what is written in this paper is expression of the author's personal opinion. It is based on experience, frustration, and disappointment. Far too often authors submit to the photographic laboratory a collection of illustrative material that makes the photographer quail in anticipation of the awful job ahead of him to turn out a presentable piece of work. Much too much illustrative material, both for lecture and for publication, falls so short of the quality of the work it illustrates that the value and appreciation of the work itself suffers. In the final analysis published work and lectures constitute a form of advertising, both for the author and the sponsoring institution. As in magazine and newspaper advertising, it is the picture that draws attention to the written copy. Ideally this should not be the case in the presentation of scientific material, but human nature being what it is, illustrations sometimes play a disproportionate part in the critical judgment of a scientific work. If a piece of work is valued by the investigator to the extent of being thought worthy of presentation, it deserves the best possible treatment in preparation. This applies not only to the written material, but also to the illustrative. It is not this author's intention to pontificate, but rather to offer some suggestions and information that might be useful to both writer and photographer.

General Considerations

It is easy for an investigator, in an excess of zeal, to present too much data in the number of graphs, charts, or tables he intends using. The usual result of this practice is relegation of important information to positions of relative obscurity. An illustration showing a trend is generally much more revealing than one pock-marked with a multitude of recorded observations. Simplicity should be the theme in any graphic exposition of data. If a reader is sufficiently interested, he will find all the information in the body of the article. This applies to a lesser extent to tabular material, but even a table containing a great deal of data can be made to appear simple and to stress important information. In the majority of situations, however, some simplification is possible. The spectre of oversimplification which seems to haunt attempts to increase clarity, is in reality seldom encountered if the article is properly written.

Not only should the photographer be given adequate time to do his job but the planning and preparation of illustrations should be done far enough in advance of any deadline to eliminate any last minute rush.

Material for Lantern Slides

The preparation of illustrative material is greatly influenced by the form in which it is finally to be reproduced.

If material is being prepared for eventual projection, severe limitations are imposed on the shape of the area which the illustration occupies, that is, if the maximum size on the screen is to be attained. American standard lantern slides are 3¼ in. x 4 in. After allowing for binding, masking, and labeling, a much smaller area remains. So that lantern slides can be projected on the same screen as motion pictures, and be comparable in size to them, a standard size mat opening of 2¼ in. x 3 in. has been adopted. There are many other size mats available for use when the occasion demands. To take fullest advantage of the area available, illustrations should not vary much from a 3:4 proportion. Some tabular material and many chemical formulas and combinations cannot be made to fit this proportion, being tall and thin or short and squat in shape. If there is any choice, a horizontal arrangement always looks better and is easier to read than a vertical one. Those who are preparing material for projection from 2 in. x 2 in. slides are in a better position, since they have a choice of either a horizontal or a vertical format if the 24mm x 36mm frame is used with the standard mat opening of 23 x 33.4mm. Thus a propor-

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tion of 4:6 is had. The preparation of plane material for motion pictures is best put into the hands of the specialists since the requirements of the movie screen are severe. In Vol. 22, No. 1 of this Journal, P. A. Conrath has written an article entitled "Television and the Medical Illustrator", which is a simple but thorough treatment of that specialized subject.

Tabular Material

In setting up tables for lantern slide projection, the vertical column rules should be drawn in, but horizontal rules kept to an absolute minimum, or eliminated entirely. A double horizontal rule to separate the title from the body of the table gives it a nice appearance. Open tables (those without any rules) should be limited to two columns. A great deal of useful information on setting up tables is to be found in any good style manual. Tables made for publication only, should be submitted in their original typewritten form. They will be set by the printer in the particular style of the publication.

Illustrations for Eventual Publication

In preparing illustrative material for eventual reproduction on the printed page, one has much more leeway with regard to proportion. Most publications have, among their instructions to authors, some description of the size, finish, and form of submission of illustrations. Double column publications, such as J.B.P.A., permit enormous variation in the shape of illustrations. Tall, narrow figures, which fit easily in a single column of such a journal, necessitate a relatively costly runaround of type in a single column publication. Full page illustrations are restricted in proportion to the shape of the printed page. However, the 5:7 proportion fits most journal pages closely enough. When it is necessary to mount several pictures together for purposes of comparison or to make a plate, the final shape should be symmetrical even if it means making a tall, narrow or short, squat illustration. It is best to avoid illustrations which require turning the book for observation. Although the author usually has not much control over this, such illustrations are best printed on a right hand page.

Typewritten Material

The paper upon which typewritten material is to be photographed should be a good, white, rag content bond. Only a black typewriter ribbon should be used. A new ribbon is desirable, but a slightly used one is satisfactory if a sheet of carbon paper is inserted in such a manner that it leaves its mark on the back of the sheet being typed on. This reinforces the blackness of the typed character from behind. Good results can never be achieved with an old ribbon! If there is no new one available, removal of the ribbon and substitution of a sheet of carbon paper inserted in such a way that the typing is done directly on it assures a sharp, black impression on the paper. Copy prepared in this manner must be handled with great care since it smudges very easily. The type in the machine must be clean, sharp, unbroken, and even. Dirty type produces generally unsharp impressions and frequently causes the loops of letters like the "e" and "a" to block up. Uneven, twisted, or out-of-line type causes portions of the characters to disappear, usually vertical strokes and serifs. Electric typewriters are excellent because of their evenness of impression and the range of type faces available. Pica type is preferable in non-electric machines since it is larger and less likely to block up.

Large masses of type-matter look very bad on the screen and should generally be avoided. Except in some special cases, typed material should be double spaced for easy reading; single spacing should almost never be used. If a large amount of material must be presented it is better to cover a large area of paper with double or triple spaced type, than to crowd a mass of material into one small piece of paper. To some people, such a crowded presentation appears on the screen as an indistinguishable blur. By referring to similar published tabular material, some guidance in the matter of spacing may be obtained.

Drawings, Graphs, and Diagrams

A good grade of white drawing paper of substantial weight should be used. The paper should have a hard, non-glossy, slightly pebbled surface. The coating and sizing materials used on some papers tend to make drawing pens stick and clog. Paper having even a slight gloss on either side should be suspected of containing these materials and their use avoided. It is often convenient to draw a graph or chart on a cross ruled paper. A paper with blue lines should be the one of choice, since the photographer may easily cause the lines to drop out. Graph

paper with green lines should never be used! It is only with difficulty that the photographer can eliminate the lines. It is seldom desirable to include the cross rulings of graph paper, and then only if the lines of the drawn portion are made exceptionally heavy.

The only kind of ink that should be used is black "India" type drawing ink. Black writing inks are lacking in opacity and may also have a bluish cast which makes them unsuitable for photography. If colored inks are used to prepare illustrations for color transparencies, the colors should be applied liberally and the colors chosen should be strong and contrasting. Large masses of color, in a transparency, are much more effective than large masses of white.

While it is possible to erase on a good grade of drawing paper, it is common practice to paint out errors with a fine brush and opaque white water colors. Paint of this kind is available at art supply counters. Major corrections are made by pasting pieces of drawing paper over the portion to be corrected, and then making the desired correction. Care should be taken to keep the edges of the paster as far from drawn lines or lettering as possible, on either the drawing or the correction. The edges of pasters almost always cast shadows when lit for photography, and if these shadows are too close to, or fall on a portion of, the drawing, they are very difficult to remove by retouching on the negative.

In making drawings, care should be taken to make the lines of adequate weight. If lines are drawn too thin, there is danger of their dropping out in photography. It is not good practice to make the whole drawing with lines of the same weight. Differences in the thickness of lines not only give the drawing a finished look, but also give emphasis to the more important parts. In a graphic exposition of data, for example, it is the curve that is most important, and should accordingly be drawn with the heaviest line. The ordinate and abscissa should be much lighter in weight. A drawing in which the same coordinates are used for more than two curves is seldom clear. In the use of shading media, such as *Zip-A-Tone*, the smaller patterns should be avoided as they tend to block up when reduced for reproduction on the printed page. If the illustration requires more than one pattern, the patterns used should be as dissimilar as possible: for example, a pattern of dots contrasted with a pattern of stripes.

It cannot be denied that good hand lettering gives a drawing a distinctive look, but since good hand letterers are few and far between, an acceptable substitute must be found. There are, fortunately, several devices available which produce neat, uniform results. With the aid of a lettering set like the *Leroy* made by Keuffel and Esser, with a little practice and a lot of patience, an amateur can produce flawless lettering. A similar, but much less expensive, outfit is the *Doric* of the same manufacturer. This set, however, contains only upper case letters. Still less expensive are the several stencil type devices, not notable for the quality of the lettering they produce.

Alphabets printed on a cellophane-like material with adhesive on the back, which are used by cutting out the desired letters and putting them in place on the illustration, are sometimes used. While the results are handsome, the time involved is excessive. *Fototype*, another kind of prepared alphabet, is useful.

A variety of letter sizes within the same drawing gives emphasis and a pleasing appearance. To prevent blocking up after reduction in size for reproduction, some judgment must be employed in selecting the smallest letter size to be used in a drawing.

Wash drawings and other continuous tone material are best submitted for publication in their original form. Halftone reproductions from photographic copies are never as good as from the originals.

Instrument Recordings

Instrument recordings on paper frequently photograph better if they are mounted with a black paper backing. There should be no writing or lettering directly on these records, as erasure is difficult or impossible without damaging the paper. If lettering is necessary, it should be on labels secured with rubber cement. Occasionally, if the recording ink is very pale, it may be necessary to strengthen the trace by going over it with a crow quill pen and india ink. The matte black surface of an unshellacked smoked paper kymograph tracing is excellent for photography; they must, however, be handled with extreme care since they are very sensitive to abrasion and smudging. Shellacked records usually

yield satisfactory results but are sometimes more difficult to photograph.

Drawings, graphs, etc. should not be made with a major dimension of more than eighteen inches or less than five inches. A photographic copy of a drawing that is too small often shows flaws and unevennesses that would not be apparent if it were drawn larger. If a drawing is made too large it is difficult for the photographer to handle and light. A margin of at least an inch should be left around all sides of a drawing.

Photographs

In preparing photographs for lantern slides, the best results are naturally to be had by using the original negative and preparing the slide by contact, enlargement, or reduction, whatever the case may be. However, lantern slide materials are excellent for printing "copy" negatives. Whenever possible, prints for publication should be made from the original negatives, and not copies. In size, they should generally be 4 in. x 5 in. or larger, and always on a glossy surface paper. If it is necessary to mount prints, as in preparing plates or making illustrations of comparisons, they should be mounted on a thin bristol board. The quality of the print for reproduction should be the best possible, consistent with the negative employed. If there is doubt or choice regarding the contrast of the print, the more contrasty one should be chosen, as a rule. Photomicrographs almost always reproduce better from prints of slightly more than normal contrast.

Arrows and lettering to be drawn on photographs should be done by a professional artist. Small identifying labels, however, may be attached to the print with rubber cement.

If it is necessary to write on the back of a photograph, and it should never be, a soft pencil used lightly, is less likely to produce strike-through on reproduction than anything else. Paper clips should never be used on photographic prints.

Photographs should always be mailed flat. They should never be rolled, since rolling frequently causes cracking of the emulsion in glossy prints.

Occasionally, neither a print nor the original negative are available, so that an illustration must be prepared from a published halftone engraving. Despite the best efforts of the photoengraver, a moire pattern in the final reproduction is likely to result; but if the photographer makes a slightly out-of-focus print from his copy negative, this unpleasant effect can largely be obviated. Photographs of halftone engravings projected as lantern slides are likely to be objectionable to persons viewing them from close by, because of the enormous magnification of the halftone screen pattern.

Conclusion

Nothing in this paper is presented as a hard and fast rule. Only suggestions to be flexibly applied are offered. It is hoped that some of them will be followed by authors interested in improving the quality of their illustrations. Without doubt, the photographer's task would be eased if more writers were aware of some of the problems in the preparation of illustrative material.

BIBLIOGRAPHY

Schmidt, L.: Prints for Reproduction and Their Arrangement for Publication, *J. Biol. Phot. Assoc.*, 1:132 (1932).

Schmidt, L.: The Preparation of Photomicrographs and the Effective Grouping of Prints in Pages, *J. Biol. Phot. Assoc.*, 3:123 (1934).

Karth, E. G.: Biological Illustration and the Photoengraver, *J. Biol. Phot. Assoc.*, 4:151 (1935).

Hewitt, R. M.: Tabular and Textual Lantern Slides, *J. Biol. Phot. Assoc.*, 5:167 (1936) (Reprinted from A.M.A. Bull. Vol. 31 #9, 1936).

Schmidt, L.: Practical Methods of Lettering, *J. Biol. Phot. Assoc.*, 10:130 (1942).

Stephenson, A. Jr.: Publishers Requirements for Prints for Publication, *J. Biol. Phot. Assoc.*, 10:172 (1942).

Sage, R. A.: Letter Height in Relation to Legibility on Standard Lantern Slides, *J. Biol. Phot. Assoc.* 17:73 (1949).

Wolf, R. D.: New Typewriter Speeds Up Preparation of Material for Making Lantern Slides, *J. Biol. Phot. Assoc.*, 17:177 (1949).

Hewitt R. M.: Legible Lantern Slides, *Pediatrics*, 7:145 (1951).

Anon.: List of References on Lantern Slides, *J. Biol. Phot. Assoc.*, 20:20 (1952).

Maresh, C., Pesyk, L., and Huselton M. L.: Improvements in Presentation of Material with Lantern Slides, *J. Biol. Phot. Assoc.*, 20:168 (1952).

Conrath, P. A.: Television and the Medical Illustrator, *J. Biol. Phot. Assoc.*, 22:22 (1954).

Britten, E. J.: A Simple Method for the Photographic Reproduction of Pencil Drawings, *Science*, 119:913 (1954).

Heitlinger, L.: Preparing Lantern Slides with Fototype, *J. Biol. Phot. Assoc.*, 22:166 (1954).

Illustrations for this paper are placed in a group on pages 178-179

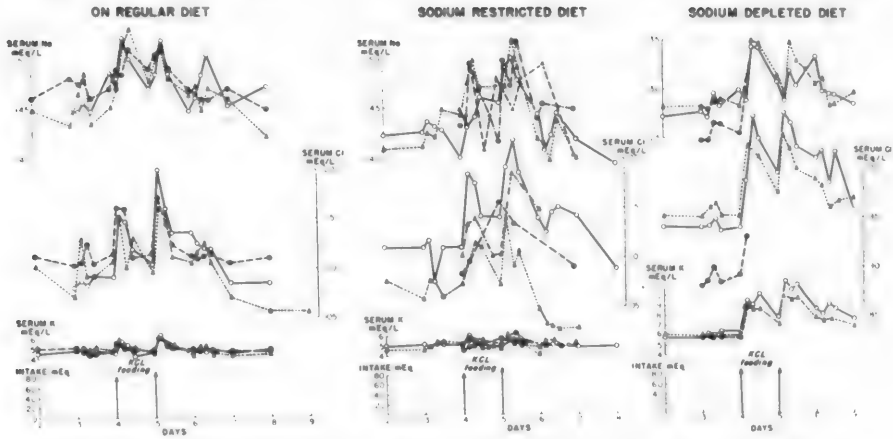


Figure 1. An attempt to present complete experimental findings in one illustration. In addition to the over-all appearance, many individual faults are evident, even to the casual observer. The original material from which this reproduction was made was larger than 30 in. by 40 in. No amount of doctoring or alteration can make a clear illustration from it. Such an illustration should be discarded and the material rearranged in a series of five or six separate illustrations.

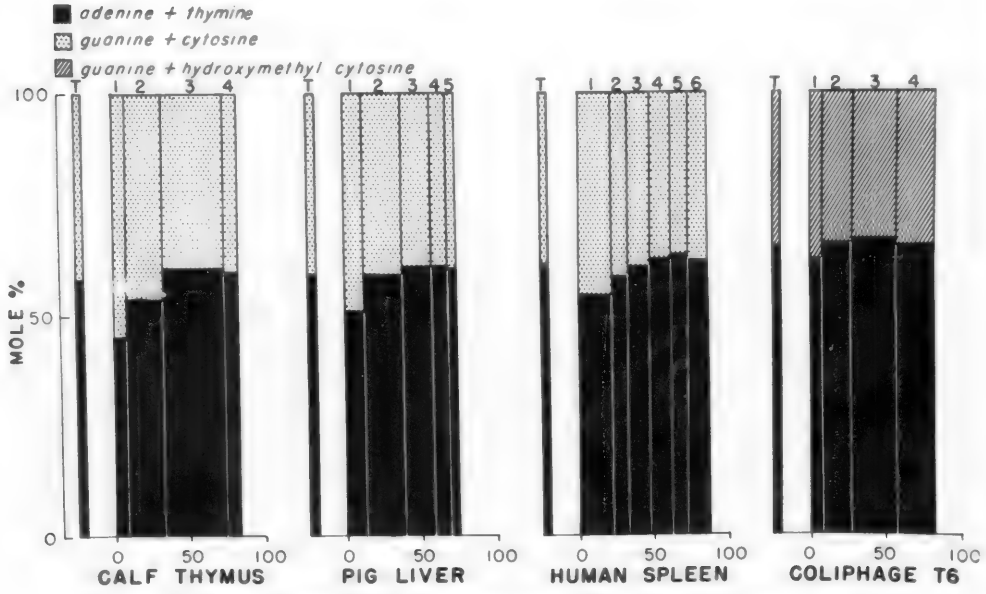


Figure 2. A good example of a clear presentation in the form of a bar-graph. This figure illustrates a use of *Zip-A-Tone* shading medium.

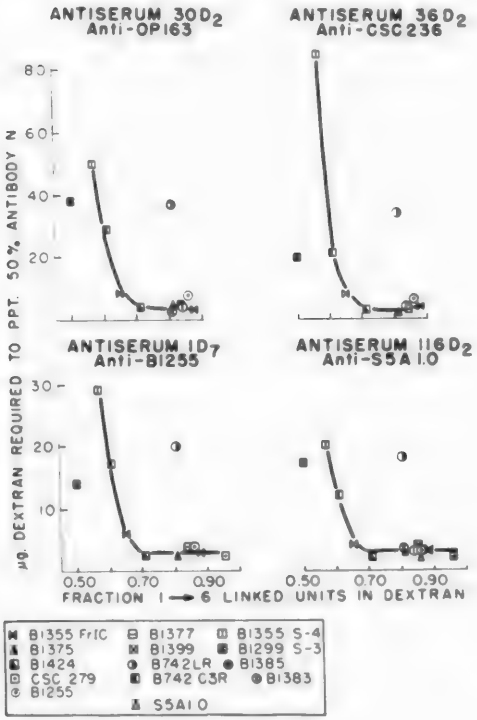


Figure 3. Many data presented in a simple and straightforward manner.

Substance	Weight Isolated in mg.	m.p. °C	Specific Activity cpm/μM x 10^4
Pregnenolone Acetate	14.0	145-149	6.9
Pregnenolone		187-192	8.4
Progesterone	15.9	128-130	11.7
B Acetate	12.7	146-148	13.6
F Acetate	2.1	212-217	12.3

Figure 4. A typewritten table set up for a lantern slide; note only one horizontal rule.

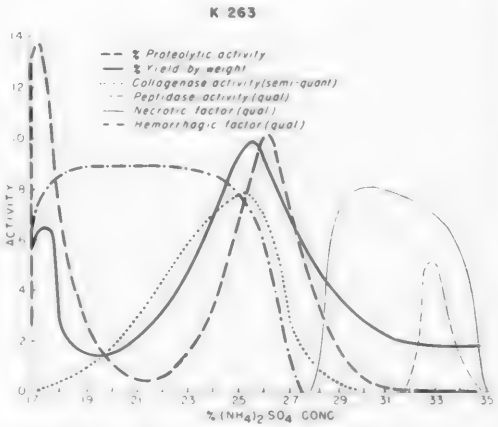


Figure 5. Such a collection of curves on one set of coordinates is like a puzzle, and is not likely to hold the reader's attention for more than a moment.

BOOK REVIEWS

MICROSCOPY FOR CHEMISTS, *Harold L. Schaeffer, D. Van Nostrand Co., New York, viii+264 pages (1953), illustrated, 6 in. x 9 in., $4.50.*

Three chapters cover optics and the microscope, followed by chapters on illumination and permanent records, including photomicrography. Polarized light and chemical microscopy occupies a third of the book and the last third is devoted to simple laboratory experiments. The book is planned as an introductory text. Many of the sections end by referring the reader to a more advanced source. The book is so over simplified that not a few of the statements are confusing and some are scarcely correct. It will, however, give the beginner some idea of chemical microscopy. (O.W.R.)

FLUORESCENCE ANALYSIS IN ULTRAVIOLET LIGHT, *J. A. Radley and J. Grant, D. Van Nostrand Co., New York, 4th ed. rev., xvi+560 pages, (1954), illustrated, 6 in. x 9 in., $12.00.*

The revision of this classic handbook is spotty. The most recent paper mentioned in the references on the production of ultraviolet is 1936, yet much progress has been made recently in this field in England. Fluorescence microscopy is covered in three pages although many recent papers are included in the reference list. Medical and biological applications are more current. The basic photographic applications make the book a useful reference for the biological photographer, especially if he may be concerned with museum or criminological applications and the new edition should be included in the department library. (O.W.R.)

INFORMATION THEORY IN BIOLOGY, *edited by Henry Quastler, University of Illinois Press, Urbana, Ill., 273 pages (1953), illustrated, 6 in. x 9 in., $4.00.*

Information theory consists in the determination of the essential units and their communication. The first section considers the definition and measurement of information in seven chapters by different authors. The next seven chapters discuss fundamental biological units in both structural and functional analysis. The third section includes five chapters on bio-systems. Some chapters include mathematics and show that much can be gained from its application to information theory. This is a stimulating technical book and applications will ultimately extend to biological photography. (O.W.R.)

U.S. CAMERA, 20th ANNIVERSARY EDITION, *1955, edited by Tom Maloney, U.S. Camera Publishing Corp., 420 Lexington Ave., New York, N.Y., 316 pages, 8½ in. x 11½ in., cloth bound, $6.95.*

In this 20th Anniversary edition of U.S. Camera, the editors made a concerted effort to bring together the best pictures of the year created by masters in America, and abroad. Hardly anyone could doubt that they have achieved their goal. Both well known names in photography and those who have not yet become sufficiently distinguished so that their names are generally known are represented. Although many of the examples are no different from what we have been seeing for many years, there are others that indicate the fact that photography is developing into a true visual art. Biological photographers will be particularly interested in the many reproductions of plant and animal life photographs. The full page color reproduction of Eliot Porter's bird pictures are unusually satisfactory. An interesting report on the National Audubon Society is written by Allen D. Cruickshank, supported by a series of bird and other animal photographs by Mr. Cruickshank. The written report and photographic reproductions of the H-Bomb Explosion in the mid-Pacific during the first week of March, 1954 is perhaps the best that has been presented in any single source for the popular reader. A valuable news chronology for the period from August, 1953 to August, 1954 is given on pages 308 to 315. A special section is devoted to nine photographs by Ansel Adams taken with the Polaroid-Land Camera on a new high-speed panchromatic film of extended exposure

range. These reproductions are printed on a very high grade paper. The results show beyond question that the recent developments in the Polaroid-Land process are fully the equal of conventional photographic procedures, and in some respects even superior.

MY BELOVED EXAKTA, *Heinz Mueller-Brunke, Variety Books, Bronxville 8, N.Y., 126 pages (1954), 9 in. x 10½ in., cloth bound, $3.00.*

This is a story in words and pictures of the author's adventures with his 35mm Exakta camera. The story part is more of the travelogue type discussion, with a minimum of technical details. However, it was not the author's purpose to present the Exakta camera in a technical manner, but rather it was to show its flexibility in taking indoor and outdoor photographs under practically all circumstances of all types of subject material. His excellent pictures show that he has a remarkable insight artistically, and undoubtedly a great amount of technical skill as well. Certainly he proves that the Exakta camera is a versatile piece of equipment even though he does not go into the details of its operation.

PHOTOGRAPHY ANNUAL, 1955, *(including the American Annual of Photography), compiled by the editors of Photography Magazine, Ziff-Davis Publishing Co., 366 Madison Ave., New York 17, N.Y., 250 pages, 8½ in. x 11 in., paper bound, $1.00.*

This is principally a compilation of reproductions from the photographic efforts of leading world photographers, many of which are in color. The first half of the annual is organized under six headings, pointing up the skills and techniques that go into the making of pictures. The first two sections deal with making camera adjustments, the next three are concerned with light, and the final group of examples exemplify some of the special techniques that can be used in taking and processing. Interspersed among the numerous reproductions are brief articles, some of which have been written by well known figures in photography such as Beaumont Newhall, Cartier-Bresson, Dave Eisendrath, etc. For those who feel it necessary to know the type of camera used, the film employed, exposure time and lens settings, a section is devoted to these details in the back of the book.

THE MICROTOMIST'S FORMULARY AND GUIDE, *Peter Gray, The Blakiston Company, Inc., New York, 794 pages, 6 in. x 9 in. (1954), cloth bound, $10.50.*

Once in several generations an elder statesman culls over the accumulated information in some field and presents the best of it in a reference volume. Professor Gray has done this for those who make microscope slides. Methods are given for whole mounts, smears, squashes, ground sections, frozen sections, injections and sections cut in nitrocellulose and paraffin embedded blocks. Formulas are provided for preserving, fixing and staining solutions. Methods are then offered for their most efficient use, and finally for mounting the preparations. Best of all, each method and material is referenced as to its origin and many of the confusions from different solutions used at different times under the same name have been resolved. A notable list of journals is included along with their numbers in the "World List". The index is very complete so that a given item may readily be found. We are all grateful to Peter Gray for the hours of scholarly work that gives us a one-volume reference library. This reviewer believes that the time saved will soon pay for the book and that it should be in every laboratory that makes preparations for study under the microscope. (O.W.R.)

THE FLOWERING CACTUS, *Raymond Carlson, Editor, with sketches by George M. Avey, and photographs and technical data by R. C. and Claire Meyer Proctor, McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N.Y., 96 pages (1954) 9 in. x 12 in., cloth bound, $7.50.*

This is a beautifully produced book containing hundreds of reproductions of black-and-white and color photographs of the flowering cactus. The photography is really first-rate and the color reproductions superb. However, the book is far more than simply a picture book of the flowering cactus. The running text gives a full biological account of the cactus, and the sketches show plant and flower detail which are not readily discernible in photographs. An interesting chapter is given on the cultivation of desert cacti and another chapter is given on photographic techniques in photographing cacti. A guide to the flowering cactus concludes the book, giving common and botanical names, growing range, and best months for flowers. This book can be highly recommended.

New Products

BEWI-AUTOMATIC EXPOSURE METER

An exposure meter with a built-in "calculating" device that automatically gives the photographer the correct exposure, by merely pressing a button, is now being offered. This is the Bewi-Automatic Exposure Meter, made by the Bertram Company in the Western Zone of Germany, and distributed in this country solely by

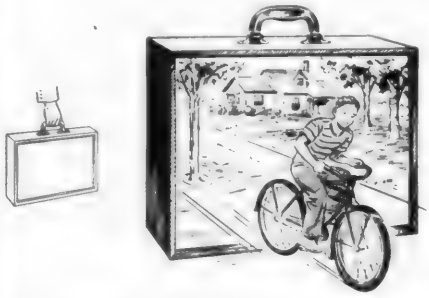
Willoughbys, 110 W. 32nd St., New York 1, N.Y. There are two operations for correct exposure (1) Press the button at the side of the meter, and the instrument reads the light. (2) Release the button to get the correct lens and shutter settings. In use, nine shutter and lens combinations appear on the dial. One selects any one pair for a particular exposure. Price $29.50.

PRICES REDUCED ON IRISH BRAND RECORDING TAPE

A price reduction on "Irish" Brand Magnetic Recording Tape has been announced by OR-Radio Industries, Inc., Opelika, Alabama, claimed to be the world's largest exclusive manufacturer of magnetic tape. "Irish" Green Band Professional #211 — 1200-ft. reel formerly listing at $5.50 is now $3.30, user's net price. "Irish" Brown Band Tape for home and general commercial recording use, 1200-ft. reel formerly listing at $3.75 is now $2.50, user's net price. Similar reductions are in effect on all other sizes and brands of "Irish" tape reels from 150-ft. to 4800-ft.

NEW PANASCOPE DIMENSIONAL VIEWING SCREEN

A new method of viewing color slides, moving pictuers and x-rays has been made possible with the Panascope Dimensional Viewing Screen, introduced by Willoughbys, 110 W. 32nd St., New York, N.Y. Said to be excellent for medical and industrial use, displays, etc., the Panascope Dimensional Viewing Screen is made of unbreakable plas-



tic material, measuring 12 in. x 16 in., with a viewing surface of 12 in. x 16 in.

The Panascope sets up on any table or tripod and can be used in conjunction with any make and model of projector. The projected scenes can be viewed from either side of the screen. It can be used even in a brightly-lit room. Price $29.50.

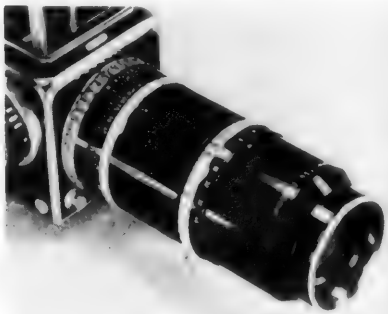
MERIX RINS

The Merix Chemical Company, 1021 East 55th St., Chicago, Illinois have released data on their Merix Rins solution which is claimed to keep negatives static-free. The concentrated solution is added to the final rinse — 10cc per liter. It is available in several quantities, the smallest being a 4 ounce bottle priced at $1.00. This is sufficient for 3 gallons when diluted.

TWO NEW LENSES FOR HASSELBLAD CAMERAS

Willoughbys, 110 W. 32nd St., New York, announces that two new lenses for the Swedish Hasselblad camera are now available in photo stores throughout the country. These lenses have been especially designed and manufactured to fit the Hasselbald models 1000F and 1600F, and are quickly interchangeable with standard lenses by means of a novel combination of thread and bayonet mount which insures positive locking.

One lens is the 60mm Carl Zeiss Distagon F/5.6 wide angle lens, for interiors, narrow streets and industrial photography or whenever it is necessary to work in cramped quar-

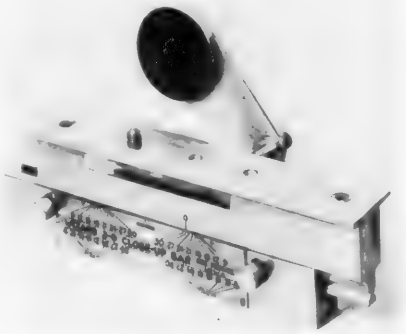


ters. This is a six-element lens, coated and color corrected, with a picture angle of 66 degrees. The lens focusses down to 20 inches from the film plane and has preset diaphragm stops with halt (or between) stops. The lens is supplied with an adapter ring, and takes standard Series VII filters. It comes in a leather case and is priced at $189.50.

The other lens is the 250mm Zeiss Sonnar F/5.6 telephoto lens (see illustration) which focuses down to 8 feet. It is coated and color-corrected. Diaphragm stops from f/5.6 to f/4.5. Takes Series VII filters, and is supplied with an adapter ring for the filters. It comes in a leather case, and is priced at $299.50.

WIZARD 3-D CLOSE-UP BAR

The Wizard 3-D Close-Up Bar is designed as an aid in difficult 3-D close-up work. It automatically reduces mathematical calculations for both stereo and single lense cameras. The bar is also calibrated with a straight 70mm shift. This makes it possible to use any ordinary camera for stereo photography of landscapes, architecture, interiors, etc. It is made of machined aluminum. The scales, for both projection and direct viewing, automatically compute the interocular sepa-



rations necessary in 3-D close-up photography. A spring-tension capping hood makes it easy to make rapid exposures when using the stereo cameras. Price $29.95, plus $.40 postage, ppd. from mfgr. If purchased in Iowa add 2% sales tax. For further details write the Wizard 3-D Company, 714 Savings & Loan Building, Des Moines, Iowa.

TECHNICAL CLOSE-UP ATTACHMENT FOR COLOR PHOTOGRAPHY

To reduce the problems of technical close-up color photography, the Eastman Kodak Company has announced a newly developed outfit, particularly suited to medical photography. Called the Kodak Technical Close-Up Outfit, it is priced at $62.75 and contains everything needed for close-up medical photography — Kodak Pony 828 Camera, flashholder, and attachments, all in one ready-to-use package.

In addition, a second unit for converting a Kodak Pony 135 or 828 camera already on hand to close-up use, is being offered as the Kodak Technical Close-Up Kit. Priced at $19.95 this includes the framing attachment, supplementary lens and filters and special Close-Up Flashguard.

The Technical Close-Up units are engineered for use by people having no experience with photography who want to produce color transparencies of maximum quality with a minimum of difficulty. Nurses, doctors, and hospital technicians who have no photographic

training can learn to use the equipment in a matter of minutes since they need master only a few basic operations. Essentially the whole Technical Close-Up Outfit is built around a simple, sturdy frame to which camera and flasholder are attached. The

frame consists of a mounting plate for camera and flasholder with two arms extending from this plate, out in front of the camera, on which a half-frame is mounted. The mounting plate positions the camera rigidly and accurately. It also positions the flasholder so that the light is beamed correctly. The half-frame in front of the camera accurately outlines the field of picture coverage — 3 in. x 4 in. at a distance of 6 inches — and automatically makes it possible for the operator to position the camera at the correct distance merely by placing the frame about ¼ in. from the subject area to be photographed.

The unit was designed with a half-frame instead of a whole frame to eliminate the shadow of the top and side of a full frame that would be cast by the light from the flashbulb or flasholder. The half-frame is clearly marked with dots and notches which indicate accurately the slightly different fields of coverage of 35mm and 828 film so that the operator can visualize the exact center of his picture.

The frame attachment as a whole is designed to accommodate a Kodak Pony 828 or Pony 135 camera. A Kodak B-C Flasholder is recommended as a light source. When used with the special flashguard which is provided this protects the patient from the heat and possible shattering of the flashbulb. This flashguard also reduces the light intensity to 1/10 of normal brilliance, the correct lighting for the extreme close-ups. On the attachment the flasholder is positioned slightly to one side of the camera to produce better light modeling and give good roundness and detail.

With the attachment correct exposures and focus are easily achieved. By following a simple guide provided with the attachment either extreme close-ups, larger body areas such as the trunk or legs, or full length body shots can be quickly made.

The new unit is designed so the frame need not be removed, even for distant shots. This makes the camera instantly usable for any

desired pictures, personal or otherwise. The frame has also been made rugged enough for field work as well as laboratory use. The simplicity and the high quality results that can be achieved with the new outfit make the camera and close-up attachments potentially useful for many fields of endeavor in addition to medicine, Kodak feels. Amateurs will find it useful for flower and nature photography, for instance. As a scientific tool it has applications in criminology, botany, entomology, biology, and palaeontology.

KRYLON DULLING SPRAY

To subdue glitter, Krylon, Inc., 2038 Washington Ave., Philadelphia, have developed "Dulling Spray" which can be applied in a moment with the touch of a finger. It was introduced recently at Station WPTZ-TV, Philadelphia's NBC outlet to solve the glare problem on commercials. It is also useful in commercial and educational art departments. An outstanding application is in the photographing of metal apparatus. Formerly, putty was used over the surfaces of shiny metal objects to be photographed to prevent glare. The coating also dispenses with elaborate lighting set-ups to modify glare.

Your Association

A section of the Journal devoted to official announcements, chapter events, and other matters of historical significance to the Association.

24th ANNUAL MEETING

The Philadelphia Chapter of BPA sponsored the 1954 Annual Meeting, held at the Chalfonte-Haddon Hall, Atlantic City, New Jersey, August 25 to 27. The program for the meeting has already appeared in the Journal, Volume 22, No. 3. The General Chairman, Mr. William J. Taylor, and his staff committee chairmen staged a noteworthy meeting of technical papers, demonstrations, and special exhibits. The committee heads who worked with Mr. Taylor were as follows:

Program: H. Lou Gibson and Robert L. Chapman; Salon: Allen Hancock and Lewis J. Sunny; Commercial Exhibits: Margaret L. Engel; and Official Photographer Pierre LeDoux.

Salon Awards

The following salon entries were chosen by the judges to receive awards:

Black and White Prints —

Clinical:

First Prize — "*Aneurysm, Abdominal Aorta*". By Gene K. Davis, Houston, Texas.

Second Prize — "*Brain Surgery*". By C. P. Hodge, Montreal, Canada.

Honorable Mention — "*Intra Orbital Venous Fistula*". By Frank G. Minello, VA Hosp., Cleveland, Ohio.

Honorable Mention — "*Cyst, Upper Lip*". By Frank G. Minello, VA Hosp., Cleveland, Ohio.

Specimen:

First Prize — "*Heart Detail of Left Ventricle Showing Endocardial Abnormalities and Lesions*". By Arthur F. Wolber, Jr., New York, New York.

Second Prize — "*Megacolon*". By Robert E. David, VA Hosp., Phila., Pa.

Honorable Mention — "*Meningioma*" By M. V. Stokes, Tuskegee, Alabama.

Honorable Mention — "*Myocardial Metastatic Melanoma*". By Dean C. Altman, VA Hosp., Portland, Ore.

Photomicrograph:

First Prize — "*Leukocytic Chemotaxis*". By Allen Weinberg, VA Hosp., Coral Gables, Fla.

Second Prize — "*Chromosome Bridge*". By Robert F. Smith, East Norwich, New York.

Honorable Mention — "*Trichinosis (larvae in muscle fiber)*". By E. Lynn Baldwin, Still College, Des Moines, Iowa.

Honorable Mention — "*Tuberculosis Enteritis*". By Dean C. Altman, VA Hosp., Portland, Ore.

Natural Science:

First Prize — "*Regenerated Buds*". By Robert F. Smith, East Norwich, New York.

The Judges awarded a Special Prize to: "*Suffering*". By Joseph T. Lappan, Mercy Hosp., Pittsburgh, Pa.

Color Prints —

Clinical:

First Prize — "*Squamous Cell Carcinoma*". By Robert S. Harper, Lovelace Fdn., Albuquerque, New Mexico.

Second Prize — "*Cortone in Eye Infection*". By John Kath, Merck Institute, Rahway, N.J.

Specimen:

First Prize — "*Thrombus in Iliac Artery*". By Students of the Rochester School of Medical Photography, Rochester, New York.

Second Prize — "Cystic Kidney". By Students of the Rochester School of Medical Photography, Rochester, New York.

Photomicrograph:

First Prize — "*Living Rabbit Egg*". By Richard D. Grill, Balto., Md.

Second Prize — "*Hydrocortisone Crystals*". By John Kath, Merck Institute, Rahway, N.J.

Natural Science:

First Prize — "*Yellow Dasies*". By Robert S. Harper, Lovelace Fdn., Albuquerque, New Mexico.

Lantern Slides —

Clinical:

First Prize — "*Lupus Erythematosis Showing Butterfly Rash*". By Charles G. Reiner, VA Hosp., Syracuse, N.Y.

Second Prize — "*Lead Poisoning*". By Allen Weinberg, VA Hosp., Coral Gables, Fla.

Specimen:

First Prize — "*Metastatic Bronchogenic Ca. of the Spleen*". By Alister MacKenzie, Rochester School of Medical Photography, Rochester, New York.

Second Prize — "*Blastomyces Dermatitidis*". By John C. Muldowny, City Hosp., Akron, Ohio.

Honorable Mention — "*Acute Cholecystitis*". By Charles G. Reiner, VA Hosp., Syracuse, N.Y.

Honorable Mention — "*Hydatidiform Mole with Fetus*". By Marjorie E. Jacobson, St. Elizabeth Hosp., Lafayette, Ind.

Honorable Mention — "*Polycystic Ovaries*". By Marjorie E. Jacobson, St. Elizabeth Hosp., Lafayette, Ind.

Photomicrograph:

First Prize — "*Coccidiodomycosis*". By William J. Cameron, Batavia, New York.

Second Prize — "*Ehlers' Danlos Syndrome*". By Luther R. Gilliam, VA Hosp., Brooklyn, N.Y.

Special Displays:

First Prize — "*Micro — Biology*". By Students of the Rochester School of Medical Photography Rochester, New York.

Second Prize — "*Nocardiosis*". By R. M. Christopher and R. D. MacIntyre, VA Center, Temple, Texas.

Honorable Mention — "*Brain Surgery*". By Charles P. Hodge, Montreal, Canada.

Honorable Mention — "*Medical Research*". By Lt. Comdr. Alex A. Gravesen, Kennedy Hospital Memphis, Tennesee.

The following Scientific Displays were exhibited at the Annual Meeting:

"*Medical Photography at the New York Hospital, Cornell Medical Center.*" A proposed indoctrination manual for residents and interns. Percy W. Brooks, FBPA, Cornell Univ. Medical College, New York, N.Y.

"*Rapid Lantern Slide Preparation*". Medical Audio Visual Department. Walter Reed Medical Center, Washington, D.C. "*The Camera in Medicine*". Bureau of Medicine and Surgery, U.S. Navy Department.

"*General Electric Closed-Circuit Color Television for Medical Surgical Use*". Presented by Walter Reed Army Medical Center with the cooperation of the General Electric Company and Wilmot Castle Company.

Best Paper Award

A committee consisting of Percy W. Brooks, Charles Lindsay, and Charles Hodges selected the paper presented by Pierre J. LeDoux as the best during the meeting. Mr. LeDoux is in the Medical Illustration Laboratory, V. A. Hospital, Wood, Wisconsin. His paper was entitled "A Photostand for Extremities".

Best Journal Paper for 1953

Julius Weber, Riverdale, N.Y. and Gershon Shapira, Zahala, Israel were given the Award for the Best Journal Paper appearing in Volume 21 (1953). Their paper, entitled "Exposure Evaluation from Photometer Measurements in Multiple Lens System Photography", appeared in Vol. 21, No. 2, pp. 11-33.

Fellowship Awards

Fellowships were presented to the following: Harold C. Baitz, Joseph D. Brubaker, John V. Butterfield, J. W. Crunelle, Julius Weber, and H. Wolfgang Zieler.

1954 LOUIS SCHMIDT AWARD PRESENTED TO FERDINAND R. HARDING

A member of the Biological Photographic Association for 22 years, Ferdinand R. Harding, served on the Board for 14 years, as President from 1943 to 1945 and as President of the Boston Chapter from 1940 to 1950. A biological photographer since 1929, preceded by eight years of commercial photography, he was made a Fellow in 1946. An associate Editor of our Journal from 1934 to 1948, his department brought to our attention many new developments in photography. He has contributed some 62 papers to our Journal. Three medical textbooks on surgery have been illustrated by him. Harding is a

Ferdinand R. Harding accepting antique reflex camera presented to him by Boston Chapter.

Consultant and Instructor at the U.S. Naval Hospital at Chelsea, Mass. and Consultant to several Departments of Harvard's Medical and Public Health Schools.

His outstanding contributions to biological photography include: improved x-ray negative reproductions, development of screen grid technic to show asymmetry, photography of the plantar aspect of the foot during weight bearing, modern phantom photography, simple apparatus for oral cavity photography, surgical motion pictures without special lights and routines for orthopedic photography.

For his advancement of biological photography, for his devoted unselfish services to our Association, for his pioneer work in establishing Chapters and for his friendly encouragement of his fellow workers, the Biological Photographic Association takes pleasure in presenting the 1954 Louis Schmidt Award to Ferdinand R. Harding, F.B.P.A. Head of the Photography Department of the Children's Hospital, Boston, Massachusetts.

Commercial Exhibitors

The following firms displayed their latest equipment and supplies. Their cooperation assisted greatly in making the meeting financially successful.

American Speedlight Corporation

Ansco

Bolsey Corporation of America

Brinkmann Instruments, Inc.

Davis and Sanford Company

E. I. du Pont de Nemours & Co., Inc.

Eastman Kodak Company

Karl Heitz, Inc.

E. Leitz, Inc.

Multiblitz Speedlights

Opplem Company, Inc.

Oscar Fisher Company

Annual Banquet

The annual banquet, which all members look forward to when attending an Annual Meeting, was again made a more relaxing and enjoyable event by the Cocktail Hour sponsored by the Eastman Kodak Company. This was held on the Sun Porch of the Chalfonte-Haddon Hall in a most splendid setting. The banquet itself was held in the Rutland Room where Dr. Edmund J. Farris, Wistar Institute, Philadelphia, Pennsylvania, Past-President of BPA, gave the main address. His subject was presented in Dr. Farris' usual humorous fashion. (It is reported that even Mrs. Farris chuckled a few times.)

The various awards were made following the banquet, with President Warren Sturgis, presiding.

CHAPTER NEWS

L. B. Brown, Chairman

Arkansas: Welcome to our newest chapter! Their official charter was granted at the last Meeting of the Board of Directors in Atlantic City this past August. Officers of this chapter are:

President: WILLIAM H. ROBINSON, Medical Illustration Laboratory, Army-Navy Hospital, Hot Springs.
Vice-Pres: PAUL CHASE, University of Arkansas Med. School.
Secretary-Treas: MARY J. MCKNIGHT, Little Rock.

Boston: The first meeting of the 1954-55 season was held at the Massachusetts General Hospital with Donald C. Withee as host. Mr. Withee, Mr. Brown and Mr. Harding reported on the Atlantic City meetings for the benefit of the Boston Chapter members who were unable to attend. Mr. Withee discussed the adaptation of 35mm. cameras for surgical photography in color and showed us some very fine examples of what he had done.

An election was held and Laurence B. Brown and Barbara Jacobs were elected to serve another term as Chairman and Secretary-Treasurer respectively.

The National Salon was on exhibit in the White Building of the Massachusetts General Hospital from September 22 to October 6 and drew many favorable comments.

The Boston Chapter is proud to claim Ferdinand R. Harding, 1954 recipient of the Schmidt Award, as founder and current active member. In honor of the occasion Mr. Harding was presented with a rare antique reflex camera. (See illustration page 187).

Southern California: The September meeting was held at the U.C.L.A. School of Medicine where Mel Fisher discussed the "Principles and Practice of Underwater Photography".

The October meeting was held at the Los Angeles County Museum where Dr. Greulich spoke on "Autoradiography". On the same program was a seminar on "The Use of Photography in Chromophotography" as discussed by Dick Ray, and "Aspects of Infrared Photography" discussed by Bill Martinsen.

Chicago: The September meeting was held in the Photographic Department of Billings Hospital. Leslie Hier, host, presented his improvised surgical camera, which, incidentally, was very successfully presented at the Annual Meeting last August. Mr. Lindsay reported on two new Ilford high speed films.

The November meeting was held at the University of Illinois when Ralph Creer gave his paper "A Critic Looks at Medical Motion Pictures". L. C. Shenberger discussed the technique of "Low Power Stereo Photomicrography" and showed some superb pictures.

Chicago had its Annual Christmas Dinner on Tuesday, December 14, with Warren Sturgis as guest of honor. Dr. Cloward of Honolulu presented "Travel Abroad", and Encyclopedia Britanica Films, Inc. showed a new release called "Christmas Through the Ages". With all this and roast beef for dinner it sounds like an excellent start for the Holiday season.

Upper Midwest: This chapter holds three or four weekend meetings a year in various nearby cities. Last year they met in Des Moines, Minneapolis and Iowa City. These meetings consist of a Saturday Scientific Section, evening banquet and business meeting, and a Sunday tour and exhibit of some sort.

In June 1954 the following officers were elected:

President: VERLIN YAMAMOTO of the VA Hospital in Des Moines.
Vice-Pres.: WENDELL HOLMQUIST of the U. of Minnesota Medical School.
Sec.-Treas.: E. LYNN BALDWIN of Still College and Hospital.

In October of this year a meeting was held in Rochester, Minn., at the Mayo Clinic. The Scientific Section consisted of a symposium on the "Preparation of Material for Publication" and a motion picture "Quality in Photographic Lenses". There was a tour of the new Mayo Clinic Diagnostic Building with special attention to the Art Program of the building. There was a demonstration of "Exhibit Preparation" by Dr. A. H. Bulbulian.

Northern Ohio: An election of officers took place last April with the following results:

President: ROBERT NEWHOUSE.
Vice-Pres.: JOSEPH MERVA.
Sec.-Treas.: A. V. BANONES.

Philadelphia: Philadelphia was host at the 24th National Convention in Atlantic City last August — and an excellent one it was too — many thanks from all chapter members who were able to enjoy this meeting.

The September meeting was held in the chapter's permanent headquarters — The American Museum of Photography. Mr. Harold Hess of Eastman Kodak discussed "Surgical Cinematography".

Mid-South: The fall meeting was held at the Kennedy Hospital in Memphis. There were three highlights on the program:

1) "Reduction Copy of Color Film"
2) Discussion of a new printing process for color film and replacing it with paper.
3) Exhibit on "Black Light Photography".

New York: The 1954-55 season got under way with a business meeting and beer party at Cornell University Medical College. Our National President, Warren Sturgis, spoke briefly on progress and aims of the Association.

At the second meeting of the season Julius Weber reviewed three aspects of photomicrography: 1) optical apparatus, 2) photographic material, 3) the specimen.

Texas: This chapter held its second annual meeting in June at Methodist hospital in Houston. There was an election with the following officers elected:

Chairman: R. M. CHRISTOPHER of the V.A. Center in Temple.

Vice-Chairman: ARCHIE HICKS of the Wynne S. Eastman Medical Photographic Laboratory in Houston.

Secretary: R. D. MACINTYRE of the V.A. Center in Temple.

Treasurer: WALTER WEB of the M. D. Anderson Research Foundation in Houston.

A September meeting was held at the same place with Gene Davis and Art Small running the show which included a paper on color television and a demonstration of color translights at the Texas Industrial Film Company.

Texas and Rochester both invited BPA for the 26th Annual Convention in 1956. It was decided in favor of Rochester but many thanks to Texas, and we hope we can make it in the near future.

Wisconsin: The last reported meeting from Wisconsin was last July at the V.A. Hospital in Wood, Wisconsin. George Spuda talked about the preparation of dye transfer prints, and there was a showing of prints by Eastman Kodak Company.

DR. GEORGE L. ROYER PROMOTED

Dr. George L. Royer, active B.P.A. member for many years, was named Administrative Assistant to the General Manager of American Cyanamid Company's Research Division, on Nov. 4, 1954. He will coordinate policies on budgets, personnel, and publications at the division's Laboratories in Stamford, Connecticut; Pearl River, New York, and Bound Brook, New Jersey.

Dr. Royer, a graduate of Akron University, received his Ph.D. in optical chemistry from Cornell University in 1932. He is a recipient of the Olney Medal in 1950 from the AATCC for outstanding achievements and contributions to the field of textile chemistry. Dr. Royer is past chairman of the North Jersey Section of the American Chemical Society, the New Jersey Section of the American Institute of Chemists and former secretary and chairman of the Division of Analytical Chemistry. He is also a Fellow of B.P.A.

CONRATH MADE PRESIDENT OF ASSOCIATION OF MEDICAL ILLUSTRATORS

Philip A. Conrath, Associate Professor and Director of Section of Medical Illustration, Saint Louis University School of Medicine, has been elected President of the Association of Medical Illustrators. He was elected president at the 9th annual meeting of the association which met at Vanderbilt University, Nashville, Tennessee, October 2 to 6, 1954. Conrath lectured on "Television in the Hospital" and presented an exhibit on "Drawing for Color TV" at the meeting. He served as vice president of the association from 1951 to 1952, Chairman of the Board of Governors from 1953-54 and is currently serving as a member of the Board of Governors.

A frequent contributor to medical publications, Professor Conrath belongs to the Biological Photographic Association and the Photographic Society of America. He will preside over the Association of Medical Illustrators' 10th annual meeting which will be held in New York in 1955.

SPECIAL MESSAGE FROM BPA PRESIDENT

THE official address of the Biological Photographic Association, and its Secretary, Miss Jane Waters, has now become:

BOX 1668
GRAND CENTRAL P.O.
NEW YORK 17, N.Y.

As announced to all members with their yearly statements, the new address went into effect along with the establishment of an office in the name of B.P.A. (Telephone: MUrray Hill 3-1590) and provision for a salary for the Secretary.

This move has far-reaching implications for our Association. We have taken a step which has long been needed, in order to standardize our operations, and to allow for expansion of activities and service to members. In stating this, I wish to call to your attention the primary object of B.P.A., as expressed in our Constitution:

> ". . . to further the study and application of photography in relation to biological science."

Service to members, then, is a means — the best means we know — to this end. This has been the guiding thought in embarking on a venture which obviously will require financing, and therefore an overhauling of our budgeting methods.

Looking forward in 1955, I am happy to tell you that you will shortly be asked to ratify a new Constitution and By-Laws for B.P.A. Our past president, C. Graham Eddy, has worked long and earnestly to revise the previous document in line with our present requirements. Members of the Board have contributed their efforts, so that the new Constitution represents the combined thinking of many people, and has your Directors' approval. It is as practical as we have been able to make it, and we believe it will provide the groundwork for situations which, up to now, we have had to meet and solve by hit-or-miss methods.

Last but not least, I want to assure you that, although progress may seem slow, the basic problems of Certification are under study, and that this program will be pushed. The more this whole matter is considered, the more do we find complicated questions which must first be answered, and the need for the cautious advance towards the regulations which will be involved.

WARREN STURGIS

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(July through September, 1954)

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Howard D. Pool, *Houston, Tex.*
Donald West, *Toronto, Canada*
Robin White, *Houston, Tex.*

MEDICAL and BIOLOGICAL ILLUSTRATION

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October, 1954

Some Conditions of the Nails. Part of a teaching display from Westminster Medical School.

Joseph Leidy. W. J. Bishop.

The Value of Graphical Material. M. D. Vernon.

Motion Study. John Hall.

The Photography of Paper Chromatograms. J. P. Berry, J. D. Cheshire and L. I. Woolf.

Self-Contained Unit for Kinemicrography with Built-In Exposure Device. H. M. Dekking.

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FELLOWSHIP PROCEDURE

Members may propose for Fellowship in the BPA other members whom they consider worthy of recognition. To be eligible for Fellowship a candidate must have been a member of the Association for five consecutive years and must possess one or more of the following qualifications:

Superior craftsmanship in still or motion picture photography of biological subjects.

Ability in photographic research in new methods or materials.

(These require submission of evidence.)

Meritorious contributions to biological photography overall through sustained organizational work.

Two sponsors are required. The sponsors should be well acquainted with the candidate's work and should be ready to furnish the Board with details of his experience and achievements. Those who wish to sponsor a member whom they believe to be eligible should request a Fellowship Application form from the Secretary of the Fellowship Committee: Miss Anne Shiras, Photographic Department, Magee Hospital, Pittsburgh 13, Pennsylvania.

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